Nos. 15-1825, 15-1865

United States Court of Appeals For The Federal Circuit

GPNE CORP.,

Plaintiff-Appellant and Cross-Appellee,

v.

APPLE, INC.,

Defendant-Appellee and Cross-Appellant.

APPEAL FROM THE UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF CALIFORNIA IN CASE NO. 12-CV-02885-LHK, JUDGE LUCY H. KOH

OPENING BRIEF FOR APPELLANT GPNE CORP.

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CERTIFICATE OF INTEREST

Counsel for the Plaintiff-Appellant GPNE Corp. certifies the following:

1. The full name of every party or amicus represented by me is:

   GPNE Corp.

2. The name of the real party in interest represented by me is:

   N/A

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

   None.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

   See List in Certificate of Interest Filed July 29, 2015 (Dkt. 14)

October 14, 2015
Date

/s/ Kalpana Srinivasan
Signature of Counsel

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STATEMENT OF RELATED CASES

No other appeal in or from the same case in the district court was previously before this or any other appellate court. Plaintiff-Appellant GPNE Corp. ("GPNE") is not aware of any case pending in this or any other court that will directly affect or be directly affected by this Court's decision in the pending appeal.

STATEMENT OF JURISDICTION

The district court had jurisdiction under 28 U.S.C. §§ 1331 and 1338(a) because this case involves a patent-infringement action brought by Plaintiff-Appellant GPNE against Defendant-Appellee Apple Inc. ("Apple"). This Court has jurisdiction under 28 U.S.C. § 1295(a)(1) because this is an appeal from a final judgment entered on June 10, 2015, the Order Denying GPNE's Renewed Motion for Judgment as a Matter of Law or Alternatively for a New Trial, and the Order Construing Claims. J.A.1 (Judgment); J.A.2-56 (Order Denying GPNE's Renewed JMOL Motion); J.A.57-115 (Order Construing Claims); *see also* Tabs 1, 2, and 3.[1] GPNE timely filed its notice of appeal on July 9, 2015. J.A.29529.

STATEMENT OF THE ISSUES

1. Did the district court err in its construction of the claim term "node" in GPNE's patent claims in its Order Construing Claims, dated August 13, 2013?

[1] "J.A." refers to the Joint Appendix. "Tab" refers to the Addendum attached to the end of this brief.

2. Did the district court err in asking the jury to resolve a dispute over the meaning of the word "pager," a term-within-the-construction of "node"?

3. Did the district court err in denying GPNE's Renewed Motion for a Judgment as a Matter of Law and entering judgment that Apple did not infringe the Asserted Patents?

4. Did the district court err in denying GPNE's Motion for a New Trial pursuant to Federal Rules of Civil Procedure 50(b) and 59?

INTRODUCTION

This appeal arises from a runaway trial that boiled down to one question: what is a "pager"? In asking the jury to resolve that question, the district court violated this Court's clear instructions that "[w]hen the parties raise an actual dispute regarding the proper scope of [a claim], the court, not the jury, must resolve that dispute." *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1360 (Fed. Cir. 2008).

Even though the word "pager" is nowhere in the Asserted Claims, the district court erroneously used the word in its construction of the claim term "node." As a direct result, the scope and meaning of the word "pager" (and relatedly, "paging system") dominated the seven-day trial on Apple's infringement of GPNE's communications patents. Apple's entire non-infringement argument at trial rested on holding up an old Motorola beeper and convincing the jury that the scope of the word "pager" as used in the term "node" was as narrow as that legacy device:

- ***[A] pager is*** designed to take ***short, very low data messages***, very reliable, long battery life, compact in size." J.A.6709 (Apple's Opening Statement, Trial Tr. at 215).[2]

- "The data that the pager sends, again, it's very modest, and the way they send it, ***the frequencies they use*** and

[2] All emphasis added unless otherwise noted.

> the coding systems they use will penetrate, ***they're very simple*** . . . ." J.A.6707 (*id.* at 213).
>
> - "Pagers have different purposes than cellular systems. ***Pagers are designed for short, critical messages*** . . ." J.A.28872 (Testimony of Dr. Kate Wilson, Apple's Expert, *id.* at 1146); *see also* J.A.28861 (*id.* at 1135 ("[P]agers are relatively passive . . . . Cell phones are always anxiously trying to figure out which cell to go to next. . . . But ***pagers don't do that***.").

Apple even suggested to the jury that the district court had condoned Apple's interpretation of the scope of the word "pager" as used in the claim term "node":

> "[T]he iPhones and iPads do not fit ***Judge Koh's paging system definitions***. . . . [A] paging system has fairly high radiating power. . . . [It] essentially screams out the information across the whole industry, and whatever pagers happen to be able to pick it up they can. But it's sort of a brute force approach."

J.A.6704, 6706 (*id.* at 210, 212).

The district court, however, had never adopted the narrow scope of the term "pager" that Apple improperly urged. In fact the opposite is true—the district court before trial treated the term "pager" as an enhanced device that was different from the legacy pager that Apple repeatedly flashed to the jury. J.A.70-71 (*Markman* Order at 14-15) (holding invention encompassed an "enhanced" pager device that could "allow for two-way data packet communications"). But the district court's rulings never explicitly became part of the construction, and the jury was left to muddle through its scope.

At *Markman*, when GPNE objected to the ambiguities that might arise over including "pager" in the construction of "node" given its modern connotations, J.A.1568-69 (*Markman* Hr'g at 80:17-81:9), the district court acknowledged the problematic nature of the word. J.A.1569 (*id.* at 81:19:24). When the district court asked Apple, presciently, whether using the term "pager" would just be "kicking the can down the road," *id.*, *i.e.*, punting the question to the jury, Apple assured the court no: "We have to look at a pager as it operates and as it's designed to operate within the full context of this disclosure," Apple argued, and based on that, Apple confirmed, "there's more to it than just a pager." J.A.1571 (*id.* at 83:1-2, 83:12-18).

And indeed, under the disclosure, the term "node" is not limited to "short, critical messages" or "high radiating power" over simulcasting technology, as Apple argued at trial. The GPNE patents teach an innovative communications system that maximizes the use of limited airwaves in a cellular-data network across multiple devices all demanding resources to send or receive data-intensive (not data-light) transmissions. Claim 44 of U.S. Patent No. 7,792,492 (the '492), J.A.273-99, and Claims 19 and 22 of U.S. Patent No. 7,570,954 (the '954), J.A.248-71, (together, the "Asserted Claims"), set forth a two-phase reservation protocol whereby nodes, *i.e.*, the mobile devices on a network, reserve network resources only when they have data packets to send. Such a sophisticated two-phase system would not be necessary if the devices in question were only sending

"short, critical messages" or "low data messages." The specification sketches out an advanced system for high-data traffic, cellular transmissions (including hand-offs between towers) where multi-feature devices send graphics using touch-sensitive writing pads often using low radiated power. J.A.276 (Figure 2); J.A.282 (Figure 8); J.A.283 (Figure 9); J.A.294 (describing cellular hand-off operation using power as low as 3 watts).

Nonetheless, because the district court's construction of the term "node" improperly imported the word "pager," the scope of that undefined term consumed every day of trial, every witness, and every argument by Apple. In turn, the core invention of the two-phase access protocol was not even addressed—Apple left the non-"node" limitations virtually untouched at trial. On such a record, and in light of *O2 Micro*, the trial result cannot stand.

STATEMENT OF THE CASE

On July 1, 2011, GPNE filed a Complaint in the District of Hawaii against Apple and others. J.A.199-222, Case No. 11-CV-00426-JMS-RLP (D. Haw. 2011). The instant action against Apple was severed and transferred to the Northern District of California where GPNE's First Amended Complaint was filed. J.A.344-54, Case No. 12-CV-2885-LHK-PSG (N.D. Cal. 2012).

On April 15, 2013, GPNE filed its Opening Brief on Claim Construction. ECF No. 69 ("GPNE *Markman* Br."). On April 29, 2013, Apple along with several

other then-defendants filed their joint responsive Claim Construction Brief. *See* ECF No. 72 ("Apple *Markman* Br."). On May 10, 2013, GPNE filed its Reply Brief. *See* ECF No. 75 ("GPNE *Markman* Reply Br."). The district court held a hearing on claim construction on June 6, 2013, ECF No. 85 ("*Markman* Hr'g Tr.") and issued its claim construction order on August 13, 2013, J.A.57-115, Tab 3, ECF No. 87 ("*Markman* Order").

On February 27, 2014, Apple moved for summary judgment on several grounds. After briefing and oral argument, the district court issued its Order granting-in-part and denying-in-part Apple's motion on April 9, 2014. ECF No. 239 ("MSJ Order"). The parties filed a Joint Pre-Trial Report on June 12, 2014. ECF No. 235. Prior to trial, Apple sought to exclude all references to the district court's previous orders, including any discussion in the district court's *Markman* Order. ECF No. 282. The district court granted Apple's motion. ECF No. 319. A jury trial commenced on October 6, 2014, on the issue of infringement and validity for Claim 44 of the '492 and Claims 19 and 22 of the '954. The trial concluded on October 22, 2014, when the jury reached a verdict of non-infringement and validity of the Asserted Claims. J.A.26704-09, ECF No. 559.

During trial, both parties filed motions seeking judgment as a matter of law ("JMOLs"), which were renewed after trial. ECF Nos. 572, 574, and 575. Both

motions were denied on June 9, 2015. J.A.2-56, Tab 2, ECF No. 594 ("JMOL Order"). Judgment was entered on June 10, 2015. J.A.1, Tab 1, ECF No. 595.

GPNE filed a timely Notice of Appeal on July 9, 2015, from the district court's claim construction order, order denying GPNE's JMOL, and judgment. J.A. 29529, ECF No. 598. Apple filed a Notice of Cross Appeal on July 21, 2015. ECF No. 600.

STATEMENT OF FACTS

I. Overview of GPNE

GPNE Corp. was founded by Gabriel Wong, the co-inventor of the Asserted Patents. Mr. Wong still serves as Director and Chairman of GPNE, and his son, Edwin Wong, serves as CEO. GPNE Corp. is the owner of the patents-in-suit and today remains an inventor-owned telecommunications licensing company based in Hawaii.

II. Overview of the Asserted Patents

In 1993, Gabriel Wong and his friend Po Sing Tsui conceived of an innovative system for transmitting data messages on data networks using a two-phase reservation process. In their system, multiple "nodes" in a network (*i.e.*, mobile devices) interact with a central controller to send and receive data packets in an efficient and organized way. Wireless networks generally operate by transmitting information using radio waves rather than wires. Radio waves,

however, are a limited resource—two devices cannot use the same frequency at the same time or else their signals will interfere. Of course, there are far too many devices and not enough frequencies to reserve a specific frequency for each device to use anytime it needs. Nor is an uninterrupted connection needed since devices do not send data every moment of every day.

The GPNE invention solves these problems with a two-step signaling process whereby devices first indicate they will need resources and then separately reserve the needed resources for subsequent data transmission. This two-phase reservation process is at the heart of most modern, data-intensive networks, such as the GPRS, EDGE & LTE networks, because the process permits multiple devices to share frequencies by sending data in packets (called packet-switching) only when the devices have data to send. This process is an improvement upon the circuit-switched connections used primarily for voice communications where continuous resources are assigned for the duration of the transmission, regardless of whether those resources throughout the transmission. By 1997, the Wongs were being told by a professor at the University of California, Irvine, that this invention was an "order of magnitude" better than any existing technology. J.A.6854-55, J.A.6857-59 (Testimony of E. Wong).

The three Asserted Claims at issue in this appeal state as follows:

Claim 44 of U.S. Patent No. 7,792,492 (the '492):

37. A first node in a data network, the data network including a plurality of nodes, the first node comprising:

at least one processor;

a memory providing code to the processor; and

at least one interface configured by the processor to:

transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;

receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmit the reserve access request signal in the second slot subsequent to receiving the first grant signal;

receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information related to an allocation of additional resources for transmitting the data packets;

transmit the data packets in response to the second grant signal,

wherein the first grant signal returns randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal;

> wherein the interface further transmits information relating to a count value,
>
> wherein the interface further transmits terminal indication information indicating that a final data packet is a last data packet; and
>
> wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

44. The first node of claim 37,

> wherein subsequent to transmission of the data packets, the first node receives a first acknowledgement on a downstream frequency, said first acknowledgement on the downstream frequency including information which informs the first node that the data packets have been received, and
>
> wherein subsequent to receiving the first acknowledgement on the downstream frequency, the first node responds with a subsequent acknowledgement on a subsequent upstream frequency which acknowledges receipt of the first acknowledgement.

Tab 4, J.A.298 (’492 Patent, col. 21 ll. 8-51, col. 22 ll. 3-14).

Claim 19 of U.S. Patent No. 7,570,954 (the ’954):

13. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

receive a clocking signal used to enable requests including a first request from the first node, the clocking signal provided from the first communication controller;

transmit the first request signal from the first node to the communication when the first node has a communication message to transmit;

receive an authorization signal from the first communication controller; and

transmit the communication message to the first communication controller subsequent to receiving said authorization signal;

wherein each of the clocking signal, the first request signal, the authorization signal, and the communication message are transmitted on differing frequencies, and

wherein the clocking signal enables a second request signal to be transmitted to the first communication controller by a second node, and wherein the second request signal can be provided simultaneous with transmission of the communication message by the first node.

18. The first node of claim 13,

wherein the communication message from the first node comprises multiple data packets, and

wherein the interface of the first node is further controlled by the processor to transmit information relating to a total number of related ones of the multiple data packets being transmitted

> together, the total number providing a count value for the communication controller to determine when the multiple data packets being transmitted together are completely received.

19. The first node of claim 18, wherein the interface is further controlled by the processor to:

> transmit randomly generated information created by the first node; and
>
> receive said randomly generated information returned from the communication controller to enable identification of the first node.

Claim 22 of U.S. Patent No. 7,570,954 (the '954):

22. The first node of claim 13, wherein the interface is further controlled by the processor to:

> transmit randomly generated information created by the first node; and
>
> receive said randomly generated information returned from the communication controller to enable identification of the first node.

Tab 5, J.A. 271 ('954 Patent, col. 16 ll. 52 to col. 17 ll. 1-12, 26-43, 51-57).

As described in the claims, the nodes and controller engage in a two-phase access protocol to let the network know that the device needs to reserve network resources (*i.e.*, airwaves) for data transmissions. The system described by the claims is an efficient way to transmit data packets because the nodes share frequencies and are allocated radio resources dynamically to accommodate many

nodes nearly simultaneously. The patents-in-suit expired in June 2014 while the litigation was pending.

SUMMARY OF ARGUMENT

The district court's judgment of non-infringement should be reversed. First, the district court erred in its construction of the claim term "node." Defining a "node" as a type of "pager" left the word open to modern-day memories of legacy pagers that are incongruous with the scope outlined in the patents' disclosures. Second, the district court erred by asking the jury to resolve a real dispute over the legal meaning of the word "pager" in plain contravention of this Court's holding in *O2 Micro*, 521 F.3d 1351. The entire trial became an exercise in asking the jury to choose a definition of the word "pager," *i.e.*, construe the claims, rather than applying the two-phase access protocol to the accused devices. Third, the district court erred in denying GPNE's renewed JMOL after GPNE presented substantial, uncontested evidence of infringement, and Apple relied entirely on improper arguments about claim scope due to the fundamentally flawed claim construction. And fourth, the district court abused its discretion in denying GPNE's alternative request for a new trial because the jury's verdict of non-infringement was a miscarriage of justice in the face of the evidentiary presentations at trial.

ARGUMENT

I. Standard of Review

A. Claim Construction

"[W]hen the district court reviews only evidence intrinsic to the patent (the patent claims and specifications, along with the patent's prosecution history), the judge's determination will amount solely to a determination of law, and the Court of Appeals will review that construction de novo." *Teva Pharmaceuticals USA, Inc. v. Sandoz, Inc.*, 135 S. Ct. 831, 841 (2015). When the court must "look beyond the patent's intrinsic evidence and to consult extrinsic evidence in order to understand, for example, the background science or the meaning of a term in the relevant art during the relevant time period," such subsidiary fact findings are reviewed for clear error. *Id.*

B. Judgment as a Matter of Law

Judgment as a matter of law ("JMOL") is appropriate when "there is no legally sufficient evidentiary basis for a reasonable jury to find for that party on that issue." Fed. R. Civ. P. 50(a)(1). The district court's decision on a JMOL motion is given *de novo* review in the Ninth Circuit. *Integrated Tech. Corp. v. Rudolph Technologies, Inc.*, 734 F.3d 1352, 1356 (Fed. Cir. 2013) (citing *Hangarter v. Provident Life & Accident Ins. Co.*, 373 F.3d 998, 1005 (9th Cir. 2004)). The Court may overturn a verdict "'if the evidence, construed in the light

most favorable to the nonmoving party, permits only one reasonable conclusion, and that conclusion is contrary to the jury's verdict.'" *Lucent Techs., Inc. v. Gateway Inc.*, 580 F.3d 1301, 1309 (Fed. Cir. 2009) (quoting *Pavao v. Pagay*, 307 F.3d 915, 918 (9th Cir. 2002)). "Under Rule 50, a court should render judgment as a matter of law when a party has been fully heard on an issue and there is no legally sufficient evidentiary basis for a reasonable jury to find for that party on that issue." *Reeves v. Sanderson Plumbing Prods.*, 530 U.S. 133, 149 (2000).

C. Motion for New Trial

Whether to grant a new trial under Federal Rule of Civil Procedure 59 is a matter of the trial court's discretion. *City Solutions, Inc. v. Clear Channel Commc'ns*, 365 F.3d 835, 843 (9th Cir. 2004). Thus, the denial of a motion for a new trial is reviewed for abuse of discretion. *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1330 (Fed. Cir. 2010) (citing *In re First Alliance Mortg. Co.*, 471 F.3d 977, 991 (9th Cir. 2006)). Courts apply a lower standard of proof to motions for new trial than they do to JMOL motions. *William Inglis & Sons Baking Co. v. ITT Cont'l Baking Co., Inc.*, 668 F.2d 1014, 1026–27 (9th Cir. 1981). "[T]he trial court may grant a new trial, even though the verdict is supported by substantial evidence, if 'the verdict is contrary to the clear weight of the evidence or is based upon evidence which is false, or to prevent, in the sound discretion of the trial court, a miscarriage of justice.'" *Wordtech Sys, Inc. v. Integrated Networks*

Solutions, Inc., 609 F.3d 1308, 1313 (Fed. Cir. 2010) (quoting *United States v. 4.0 Acres of Land*, 175 F.3d 1133, 1139 (9th Cir. 1999)).

II. The District Court Erred in Its Construction of the Term "Node"

The district court erred in construing the term "node" as a "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." J.A. 114. Such a construction does not comport with the specification and claim language. In contrast, GPNE's proposed construction of a "device in a network that can transmit and receive information" captures the multi-feature wireless devices described in the claims and the specification for use in data-intensive networks that would require the claimed two-phase reservation protocol. The district court arrived at its complicated construction—which neither party proposed—after wrongly importing limitations from the specification about the relationship between the invention and telephone networks.

A. Law Governing Claim Construction

"Determining literal infringement is a two-step process: the proper construction of the asserted claim and a determination whether the claim as properly construed reads on the accused product or method." *ActiveVideo Networks, Inc. v. Verizon Commc'ns, Inc.*, 694 F.3d 1312, 1319 (Fed. Cir. 2012) (internal quotes omitted). Infringement, the second question, is a fact question for

the jury, but claim construction "is exclusively within the province of the court." *Markman v. Westview Instruments*, 517 U.S. 370, 372 (1996).

When construing claims, black letter law holds that "the words of a claim are generally given their ordinary and customary meaning." *Phillips v. ARW Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc). This is the "meaning[] to one of skill in the art when read in the context of the specification and prosecution history." *TomTom, Inc. v. Adolph*, 790 F.3d 1315, 1328 (Fed. Cir. 2015). The relevant time frame for this inquiry is not today, but is instead "the time of the invention." *Phillips*, 415 F.3d at 1312. This black letter law applies equally to resolving disputes over "a claim term or a disputed term within a claim construction." *Advanced Fiber Technologies (AFT) Trust v. J & L Fiber Servs., Inc.*, 674 F.3d 1365, 1373-74 (Fed. Cir. 2012); *see also Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1334 (Fed. Cir. 2009) (concluding that the district court correctly clarified the "disputed definition" that was provided in the initial claim construction).

In construing terms, first the court looks to the "intrinsic evidence," because it is the "most significant source of the legally operative meaning of disputed claim language." *Vitronics Corp. v. Conceptronic Inc.*, 90 F.3d 1576, 1582 (Fed.Cir. 1996). Intrinsic evidence includes the "claim language, the written description, and, if introduced, the prosecution history." *Phonometrics, Inc. v. N. Telecom Inc.*,

133 F.3d 1459, 1464 (Fed.Cir. 1998). But "[t]he starting point for any claim construction must be the claims themselves." *TomTom*, 790 F.3d at 1328. Although the claims are read in view of the specification, limitations from an embodiment should not be imported into the claims. *Id.* (citing *Hill-Rom Servs. Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014)). Claim terms are also read in light of each other, and "[t]here is presumed to be a difference in meaning and scope when different words or phrases are used in separate claims." *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1187 (Fed. Cir. 1998). Although "less significant than the intrinsic record" and "less reliable," courts may also consider "extrinsic evidence," which "consists of all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises." *Phillips*, 415 F.3d at 1317-18 (internal quotation marks omitted).

B. The Construction of the Term "Node" Should Not Have Included the Word "Pager"

At *Markman*, the parties each proposed constructions of the term node, and the district court ultimately adopted its own construction:

Disputed claim term: "node"		
GPNE's Proposal	Apple's Proposal	Court's Construction
"device in a network that can transmit and receive information"	"pager in a network operating independently of a telephone network"	"pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network."

J.A.64 (*Markman* Order).

The great weight of intrinsic evidence supports the construction of the term node sought by GPNE: "device in a network that can transmit and receive information." This interpretation is also supported by the extrinsic evidence. In reaching its construction that used terms such as "pager" and "paging system that operates independently from a telephone network," the district court improperly imported limitations from the specification. The district court's construction of the term "node" was legal error.

1. *The Intrinsic Evidence Supports GPNE's Construction*

GPNE's proposed construction properly reflects the intrinsic evidence, including the claims and specification. The claim language itself makes no reference to either a pager or paging system, instead describing a general purpose electronic communications "node" or device that operates in a "data network" by transmitting and receiving information through a two-phase reservation protocol:

> 37. A first node in a data network, the data network including a plurality of nodes, the first node comprising:
> at least one processor;
> a memory providing code to the processor; and
> at least one interface configured by the processor to:
> transmit a random access request signal . . .

See, e.g., J.A.298 (Claim 44 of the '492 depending on Claim 37). The Asserted Claims from the '954 start with similar language. *See* J.A.271 (Claims 19 and 22 of the '954, depending on Claim 13). There is nothing in the claim language that

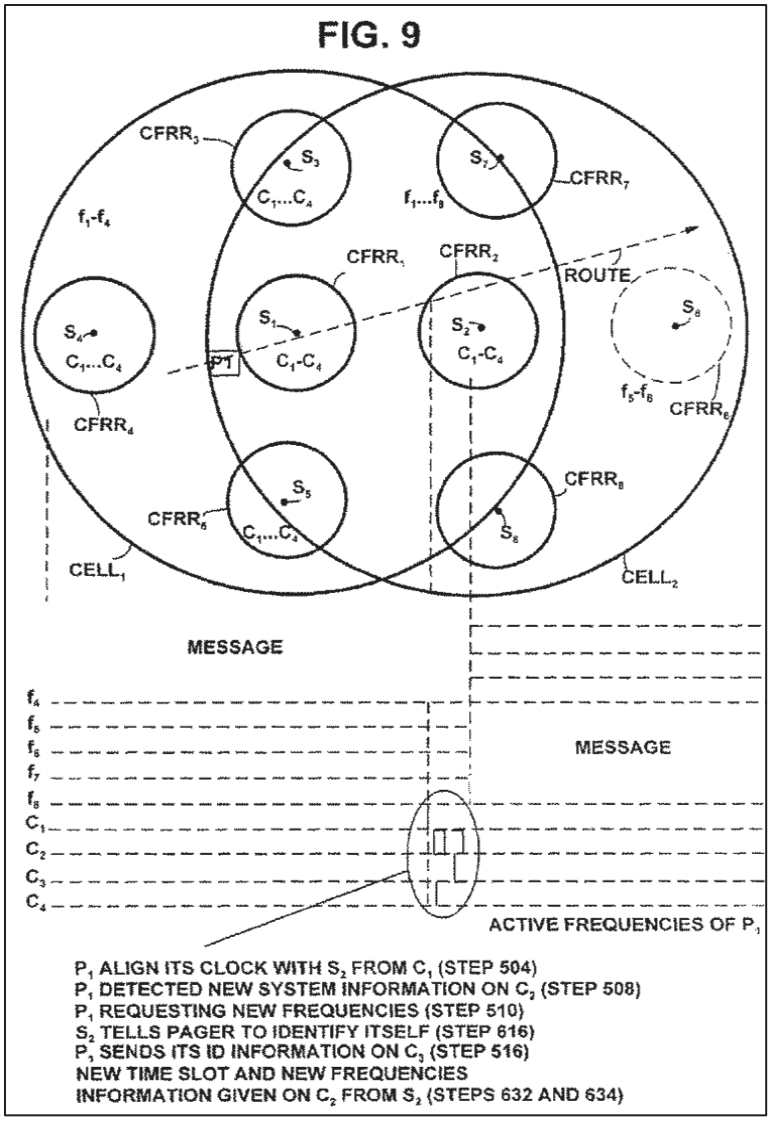
would require defining the term "node" as a "pager" on a "paging system," or mandating that the data network "operat[e] independently from a telephone network." Indeed, there is no reason to specify the nature of the system at all in the construction of the term "node" because the limitation "data network" already appears separately in the claim.

It is well established that "if an apparatus claim recites a general structure without limiting that structure to a specific subset of structures, we will generally construe the term to cover all known types of that structure that the patent disclosure supports." *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) (holding structural term "member" not limited to example in preferred embodiment); *see Sjolund v. Musland*, 847 F.2d 1573, 1581–82 (Fed. Cir. 1988) (declining to limit claim term "baffle" to only rigid baffles and term "panel" to only panels of lattice construction and noting it would have been error for jury to construe such limitations into these terms); *see also Lucent Technologies, Inc. v. Gateway, Inc.*, 525 F.3d 1200, 1206 (Fed. Cir. 2008) (reversing narrow construction of term "terminal device" where there was "nothing in the claims to suggest a construction requiring that the terminal device manage its associated display itself and to exclude control by the host processor of the positioning of objects on the terminal display"). Under these principles, "node" should not have been narrowed absent support in the specification.

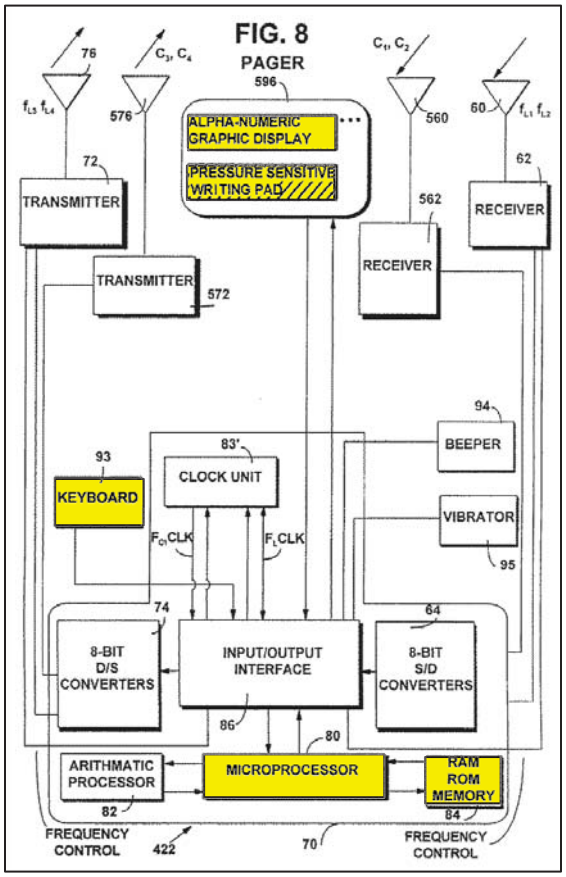
GPNE's construction of the term "node" as a "device in a network that can transmit and receive information" is well-supported by the claim language and the disclosure. The '492 and the '954 patents themselves are both directed in their titles to various forms of "communication system[s]" wherein a "node" sends and receives messages from a controller. J.A.273; J.A.248. The claims outline an advanced reservation protocol for transmitting data, the entire purpose of which is to help data networks handle heavy two-way data traffic. First, a random access request signal is sent to indicate that the node "requires an allocation of resources to transmit a reserve access request signal." J.A.298. This first signal is a short transmission that simply indicates that the device has a longer message it would like to send. J.A.508 (GPNE *Markman* Br. at 2). Once the device has been granted the first set of resources (the first grant), the device then sends the "reserve access request signal," after which it receives "an allocation of additional resources" (the second grant) for the device to "transmit[] the data packets" that "contain[] a message." J.A.298 (Claim 44). This two-step process enables the transmission of data messages of all kinds of sizes, including data-rich graphics, and would not be necessary if the devices were only sending low-data messages.

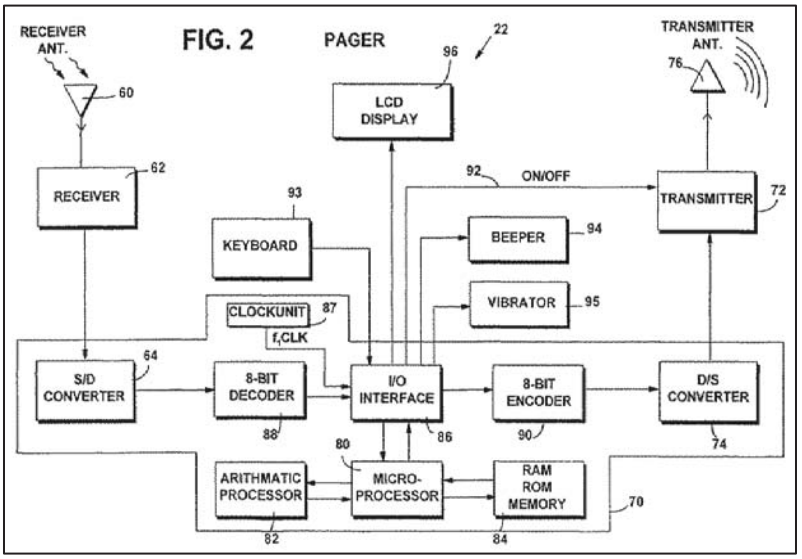
Consistent with the claims, the specification provides for a device that can (1) transmit data-intensive messages like graphics, (2) across a range of powers including as low as 3 watts, (3) in a system that tracks the location of the device

using cellular handover, deleting the registration of the unit after it leaves a certain geographical area. *See, e.g.*, J.A.293-94 ('492 Patent, col. 11 ll. 6-22, col. 13 ll. 39-49); see also J.A.294 (*id.* at col. 14 ll. 41-49 (describing possibility of including "multi-language keyboards or writing pads" that "could also be used to sketch and transmit graphics"). For example, in describing Figure 9, which contains a preferred embodiment, the patents teach the ability to perform a "switching or hand-off operation":



J.A.283 (Figure 9). Other figures reflecting preferred embodiments, although described as "pagers," or "paging units," depict general purpose, multi-feature devices:





J.A.276 (Figure 2); J.A. 282 (Figure 8). The devices described use the word "pager," but in substance show devices with graphics displays, a "pressure sensitive writing pad," and an "8-bit decoder" for images. *Id.* These devices function more like minicomputers than pagers or even the cell phones of the early 1990s at the time of the invention. The disclosure is entirely consistent with a "device in a network that can transmit and receive information."

The prosecution history also supports GPNE's construction. During prosecution, Gabriel Wong, one of the inventors, submitted a Rule 131 declaration identifying the features of the claimed system and attaching his handwritten notes from conception in 1993. J.A.651-J.A.683 (Ex. F, Hartsell Decl., GPNE *Markman* Br.). In this history, Gabriel Wong explained that his invention was a marked improvement over previous systems because it could be used to send and receive data over a packetized-data network rather than a circuit-switched network, which requires dedicated resources. J.A.657 (invention could send messages "without the use of telephone switching equipment").

Mr. Wong's notes describe a data network where devices can "[r]oam[] from one region to another" using a "switching system" to enable the crossover. J.A.661-62. The devices themselves included "data compression program[s]," "[m]ulti-language keyboard," a "[w]riting pad," a display with the ability to conduct "[o]n screen word processing," and even advanced software routines as "[l]anguage translator, calendar, reminder, database, alarm clock, and dictionaries," which could be implemented "through additional programming" on the devices. J.A.663-64; *see also* J.A.679 (showing image of 5-inch long device with 3-inch long display and writing pad). Mr. Wong also noted that "by reducing power requirement"—simulcasting pagers are associated with much higher power

requirements to enable their messages—"we can achieve a lighter communication device." J.A.666.

In short, Gabriel Wong described more than just a legacy pager and even more than two-way pagers (which had already been invented); rather, Mr. Wong's invention called for a revolutionary way of transmitting packetized data messages using a mobile device on a cellular network by allocating resources in an efficient way. This purpose of his invention supports GPNE's construction of the term "node" and would be entirely inconsistent with legacy pagers, which do not require the same type of resource sharing. *See Minnesota Min. & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1566 (Fed. Cir. 1992) (looking to the "fundamental purpose and significance of the [patented] invention" in construing claim terms); *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 450 (Fed. Cir. 1986) (construing term in light of "the inventor's purposes").

Apple tried to argue both at *Markman* and again (impermissibly) at trial that in this declaration GPNE disclaimed cell phones or cellular networks entirely. J.A.730-31 (Apple *Markman* Br. at 6-7) (citing Rule 131 Declaration for proposition that claimed device "can be made smaller than cellular phone"); *see* J.A.6687-88 (Trial Tr. at 193-94) ("Cell phones were alive and well and in existence in 1994. . . . And these inventors said, over and over and over again, that our invention is about a pager. It's not about a cell phone."). But Apple's

interpretation strains the document. Mr. Wong noted the advantages of his system over *existing* cell phones in 1993, which generally did not send data (or if they did, utilized circuit-switching connections to do so). Mr. Wong explained how in his invention, the data transmission would occur instead via packet-switching connections where messages are broken into packets and can thus share a frequency. J.A.665 (Rule 131 Decl.) (identifying "two way wireless data communication" system that does not require "telephone switching equipment," *i.e.*, circuit-switching technology). Mr. Wong also explained how his invention obviated the need to return a page using a *traditional* telephone. J.A.666 ("Returning page call. It can operate independently from the existing telephone system to return a page call. (emphasis added)). At no point did Mr. Wong state that the device claimed in his invention must be *incapable* of also accessing telephone networks.

In fact, the district court explicitly recognized that the term "'node' is not precluded from also having the capability of operating on the telephone network," J.A.70-72 (*Markman* Order at 14-15, 16), and that a pager could "transmit certain data communications on a paging system that 'operates independently from [the] telephone system, while engaging in other types of communications on the telephone system," J.A.73 (*id.* at 17). That the district court had to provide such caveats and clarifications in its order—which were not captured anywhere in the

construction itself—only underscores that the construction of "node" was incorrect and should not have contained the "pager" and "paging system" limitations.

2. *The Extrinsic Evidence Supports GPNE's Construction*

The extrinsic evidence also supports GPNE's construction. The primary extrinsic evidence cited by the district court was the testimony of Dr. Esmael Dinan, an expert with more than 20 years of experience in the area of wireless telecommunications and the holder of multiple patents in this space himself.[3]

Dr. Dinan provided background on the state of the art in 1993 and 1994, explaining that traditionally pagers at that time were "for the purpose of signaling that a live telephone call was requested by the paging party so that the paged party would call him back." J.A.626-630 (Ex. E, Hartsell Decl., GPNE *Markman* Br., ¶ 26). In contrast, when reviewing the patents as a person of skill in the art would at the time of the invention, they disclose a "two-way data communication system where the devices can send and receive data packets (messages, images, graphics, etc) back and forth in a network, obviating the necessity of the telephone call in the first place." J.A.626 (*id.* at ¶ 27). Such devices are not the "'pagers' of the time per se, but *enhanced devices*" or "enhanced pagers" that a person of skill in the art would understand are capable of doing much more and operating in a different way

[3] With respect to the dictionary definitions, the district court found them unpersuasive and made no fact findings.

than how we think of a legacy pager today. *Id.* Dr. Dinan further explained how the USPTO, in reviewing the prior art, clearly equated the term "nodes" with any number of handheld devices that were not limited to legacy "pager devices," including various portable hand-held computers. J.A.627-28 (*id.* at ¶ 31).

The district court agreed that Dr. Dinan's testimony supported a construction of the word "node" that encompassed enhanced devices capable of two-way data packet communications, J.A.70 (*Markman* Order), but nonetheless persisted in using the term "pager" without adding that critical detail.

3. *The District Court Erred in Importing Limitations from the Specification*

The district court also erred by importing the "operate independently of a telephone network" limitation into the term "node." "'Although the specification may aid the court in interpreting the meaning of disputed claim language, particular embodiments and examples appearing in the specification will not generally be read into the claims.'" *Comark Commc'ns*, 156 F.3d at 1187 (quoting *Constant v. Advanced Micro–Devices, Inc.*, 848 F.2d 1560, 1571 (Fed. Cir. 1988) (internal citation omitted)); *see also Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 865, (Fed. Cir. 1988) ("References to a preferred embodiment, such as those often present in a specification, are not claim limitations.").

The district court's insertion of the phrase "operate independently of a telephone network" into the construction of the term "node," when the "data

network" was already present as a separate limitation, was based entirely on a single summation sentence in the specification: "Thus, the invention provides a two-way paging system which operates independently from a telephone system for wireless data communication between users." J.A.294 ('492 Patent, col. 14 ll. 14-16). This single sentence was not a limitation on the scope of the claim term "node"; rather it described one method for returning a "page" in which the person need not find a telephone to make a separate call. And, as discussed above, the intrinsic evidence cited by Apple as supposedly distinguishing the patents from cell phones that existed at the time did so only to demonstrate that the data communications called for by the patents did not need to use a circuit-switched connection for returning a "page." This evidence did not preclude a device used to transmit data from also handling calls on a phone network. J.A.628-30 (Dinan Decl. ¶¶ 32-36); *see also* J.A.665 (Rule 131 Decl.).

Networks are typically viewed as either packet-switching (information is broken into packets and sent in pieces) or circuit-switching (information is sent continuously over a designated circuit, much like a wired connection sends information). The GPNE patents make use of the former system calling for packetized data; indeed, it would make no sense to use GPNE's two-phase reservation protocol to send data over a circuit-switched network because in circuit-switched networks, resources are reserved for one line at a time and that

line is always kept reserved during the transmission. There is no efficient allocation of access by reserving space only when needed over a circuit-switching network. By distinguishing packetized data transmissions from circuit-switched transmissions, GPNE did not preclude devices from also sending voice over a circuit-switched network, as was customary at the time, or suggest that the packet-switched network itself must be entirely "independent" of a circuit-switched telephone network and share no equipment or technology. To hold otherwise, as GPNE explained in its *Markman* briefing, would be inconsistent with the multiple references to telephone equipment in other parts of the disclosure:

> Figures 1 and 3, and the associated specification disclose the presence of a telephone answering system and that the control station can field telephone calls for the pager. [Patents-in-Suit], Col. 3-Col. 6 (Fig. 1 (items 48 and 36), Fig. 3 (steps 108 and 112), and Fig. 7 (items 448 and 36) all show "phone" elements integrated with the paging system described in the Patents.)

J.A.512 (GPNE *Markman* Br. at 6).

The district court misappropriated the language in the specification about independent operation when inserting it into the claim construction. In *Hill-Rom*, for example, the district court held that the term "datalink" required a physical cable, *i.e.*, a wired connection, based on the presence of a cable in a figure depicting the preferred embodiment. This Court agreed with the patent holder that there was no basis to import this limitation into the claim term itself, which did not

differentiate between a wired or wireless datalink, finding no explicit disclaimer or lexicography:

> The patents-in-suit do not describe the invention as limited to a wired datalink. There is no disclosure that, for example, the present invention "is," "includes," or "refers to" a wired datalink and there is nothing expressing the advantages, importance, or essentiality of using a wired as opposed to wireless datalink. Nor is there language of limitation or restriction of the datalink. Nothing in the specification or prosecution history makes clear that the invention is limited to use of a cable as a datalink. Absent such language, we do not import limitations from the specification into the claims.

Hill-Rom, 755 F.3d at 1372-73. The same is true here. Because the patents do not explicitly disclaim the use of a telephone network, the term "node" should not be defined to preclude such operation.

4. *Principles of Claim Differentiation Support GPNE's Construction*

GPNE's construction of the term "node," which does not call for the word "pager," is also consistent with the principle of claim differentiation. "There is presumed to be a difference in meaning and scope when different words or phrases are used in separate claims." *Comark Commc'ns, Inc.*, 156 F.3d at 1187 (internal quotation marks omitted). Claim differentiation also applies to claims among patent families stemming from the same parent specification because there is a presumption that "the same claim term in the same patent or related patents carries the same construed meaning." *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1334 (Fed. Cir. 2003). The parent to the '492 and the '594 is U.S. Patent No.

5,542,115 (the ’115). J.A.759-780. All of the patents in this family share the same specification and figures. J.A.4122 (MSJ Order at 2).

The ’115 Patent contains several claims directed to a specific subset of wireless devices known as pagers and thus makes use of the specific terms related to “paging”:

> 1. The method of operating a **paging system**, the **paging system** including a central control station and a **paging unit**, the method comprising:
>
> transmitting, on a first frequency, a clock-aligning signal from the central control station;
>
> . . .

J.A.779 (Claim 1, ’115 Patent) (emphasis added); *see also* J.A.782-803 (U.S. Patent No. 5,729,827) (Claim 1: a “two-way **paging unit** capable acquiring radio communication with a control station, . . . ”); J.A.805-826 (U.S. Patent No. 6,108,520) (Claim 1: “a method of operating a two-way **paging system**, the method comprising: transmitting a request-enabling signal from a central station to a **pager** . . . ”).

Because the terms “pager” and “paging system” appear in other claims, it was error to give “node” the same scope. This rule “is fixed. It is long and well established. It enjoys an immutable and universally applicable status comparatively rare among rules of law. . . . : Where some claims are broad and others narrow, the narrow claim limitations cannot be read into the broad whether to avoid invalidity or to escape infringement.” *D.M.I., Inc. v. Deere & Co.*, 755 F.2d 1570, 1574 (Fed.

Cir. 1985). In *D.M.I.*, for example, this Court refused to limit the independent means-plus-function claims "to compensating means formed of a parallelogram," where other dependent claims required specific formation of a parallelogram. *Id.* The same rule applies here. By limiting the term "node" to "pagers" on "paging systems" when those narrower terms are explicitly used in other claims, the district court violated this basic tenet of claim construction. *See also Free Motion Fitness, Inc. v. Cybex Int'l, Inc.*, 423 F.3d 1343, 1351 (Fed. Cir. 2005) (reversing construction that limited a claim to a single cable rather than one or more cables when other claims were explicitly limited to having only one cable).

C. GPNE Did Not Waive Its Claim Construction Arguments

The district court held that several of GPNE's claim construction arguments raised in its Renewed JMOL after trial were waived.[4] First, the district court held that some of GPNE's arguments were "new," ignoring the well-established rule that on appeal parties may offer *additional support* for the construction they sought below, as long as the scope of the construction sought remains the same (which it

[4] The district court also held that GPNE waived its arguments with respect to the ambiguity in the word "pager" because "GPNE never requested that the Court provide a more detailed construction of 'pager' or 'node' until well into the trial." J.A.17 (JMOL Order at 16 & Section III.A.1.b.i). Because this holding primarily relates to whether GPNE was required to seek a construction-within-a-construction of the term "pager," even though GPNE had repeatedly objected to the use of the word "pager" at *Markman* and at trial, it will be discussed in Section II.A in connection with the district court's decision to have the jury define the term.

does). And second, the district court held that GPNE failed to seek reconsideration of the district court's claim construction order, even though such a motion is not required and would waste judicial resources.

1. *GPNE May Offer Further Support for its Construction of "Node" Because it Seeks the Same Construction as at Markman*

The district court held that two of GPNE's claim construction arguments were waived on the basis that the arguments had not been advanced during claim construction. J.A.15 (JMOL Order at 14). Specifically, the district court disregarded the above arguments relating to the purpose of the invention and the principle of claims differentiation. GPNE did not waive these arguments. For procedural matters not unique to patent law, such as waiver, this Court applies the law of the regional circuit. *See, e.g.*, *CollegeNet, Inc. v. ApplyYourself, Inc.*, 418 F.3d 1225, 1234 (Fed. Cir. 2005) (applying Ninth Circuit case law to question of waiver).

The Ninth Circuit has long held, consistent with Supreme Court precedent, that "'parties are not limited to the precise arguments they made below.'" *Thompson v. Runnels*, 705 F.3d 1089, 1098 (9th Cir. 2013) (quoting *Lebron v. Nat'l R.R. Passenger Corp.*, 513, U.S. 374, 379 (1995)). This is because "it is claims that are deemed waived or forfeited, not arguments." *United States v. Pallares-Galan*, 359 F.3d 1088, 1095 (9th Cir. 2004). Therefore, this Court "may consider new

legal arguments raised by the parties relating to claims previously raised in the litigation." *Thompson*, 705 F.3d at 1098.

GPNE's position that the construction of the term "node" should be "a device in a network that can transmit and receive information" is the exact same position that GPNE advanced before the district court. It is well-established in this Court that although parties cannot seek constructions of *different terms* and cannot argue for *different constructions* or change the scope of a construed term, parties can offer *new supporting arguments* that were not first presented below in support of a previously sought construction. *See Interactive Gift Exp., Inc. v. Compuserve Inc.*, 256 F.3d 1323, 1347 (Fed. Cir. 2001)("[W]e hold that arguments that are based on a specification in evidence and that are in support of an existing claim construction are not barred by the doctrine of waiver for the sole reason that they were not first presented to the trial court.") (precluding party from advancing new arguments that changed the scope of a claim construction sought below, but not precluding submission of new arguments in support of a construction of the same scope advocated below, if based on record evidence like the specification). Thus, the district court erred in concluding that GPNE could not offer additional support for its construction.

The district court relied on two Federal Circuit cases but neither apply: *Cordis Corp. v. Boston Scientific Corp.*, 561 F.3d 1319, 1331 (Fed. Cir. 2009) and

Conoco, Inc. v. Energy & Envtl. Int'l, L.C., 460 F.3d 1349, 1359 (Fed. Cir. 2006)). In *Cordis*, the Court declined to consider claim construction arguments raised for the first time in a JMOL motion, holding that under *Conoco*, "litigants waive their right to present new claim construction disputes if they are raised for the first time after trial." 561 F.3d at 1331. But in *Cordis*, unlike here, the party's proposed construction for a term was raised for the first time in JMOL or on appeal. For one term, the construction had been advanced previously, but *in a different case*. *Conoco* reached the same result, citing *Interactive Gift* favorably: A party waived the construction of a claim term when it never asked for the construction until JMOL motions. GPNE advocates for the same scope of the term "node" as it sought during *Markman*; therefore, GPNE is not foreclosed from offering additional legal arguments to support its construction.

2. *GPNE Was Not Required to Seek Reconsideration of the District Court's Claim Construction Order to Preserve the Issue for Appeal*

The district court also held that GPNE's proposed construction of "node" was waived because GPNE failed to seek reconsideration of the court's claim construction order. J.A.16-17 (JMOL Order at 15-16). The district court cites no case to support this argument, and GPNE has found none. *S.E.C. v. Mayhew*, 121 F.3d 44, 53–54 (2d Cir. 1997) ("Generally, a party disadvantaged by a district court's ruling is not required to move for reconsideration in the district court as a

precondition to an appeal from the ruling."). Indeed, such a rule would lead to judicial inefficiency and waste because it would require every party upon losing claim construction to seek reconsideration in order to preserve its argument for appeal.

III. The District Court Erred in Asking the Jury to Resolve a Dispute Over the Scope of the Claims

After using the word "pager" in the construction of the term "node," and after seemingly agreeing with GPNE that the scope of the term "pager" encompassed enhanced devices and not merely legacy pagers, the district court erred in allowing a dispute over the legal meaning (*i.e.*, the scope) of the term "pager" to go to the jury. "When the parties raise an actual dispute regarding the proper scope of a patent claim, the court, not the jury, must resolve that dispute." *O2 Micro Int'l Ltd.*, 521 F.3d at 1360. GPNE did not waive this argument.

A. Prior to Trial, the District Court Made Clear that the Term "Pager" Was Not Limited to Legacy Pagers

As early as *Markman*, GPNE expressed serious reservations about any construction of the term "node" that made use of the word "pager" because of concerns about ambiguity. J.A.510 (GPNE *Markman* Br. at 4). GPNE recognized that unskilled persons today may associate the word "pager" with only a narrow subset of devices—legacy pagers using high-power, low-data transmissions via simulcasting. And at trial, that's exactly what Apple told them they should think of when considering the word "pager."

The district court initially shared GPNE's concerns about the scope of the word "pager," asking at the *Markman* hearing "what is a pager? How are we going to define 'pager'?" J.A.1569-70 (*Markman* Hr'g Tr. 81:19-82:2). GPNE accurately predicted that if the term "pager" found its way into the construction, Apple would try to argue either at summary judgment or trial that "'we make phones and e-readers and tablets,' not whatever we decide a pager is." J.A.1553 (*id.* at 65:5-11); J.A.1568 (*id.* at 80:17-24). At the time, Apple brushed aside these concerns as unfounded because *Apple agreed* that there was more to the term node than "just a pager." J.A.1571 (*id.* at 83:15-18) ("I don't think we're setting up a situation where we construe the construction just because the word 'pager' appears as the construction of 'node' because *there's more to it than just a pager.*"); J.A.1572 (*id.* at 84:3-5) ("[At trial] we're going to be talking about *more than just a pager*.").

Despite persisting in using the words "pager" and "paging system," the district court seemingly resolved the dispute over their scope in GPNE's favor. The district court repeatedly explained in its *Markman* Order that "pager" used in the construction of "node" was broader than legacy pagers:

- Here, a "pager" is an "enhanced" device that could "allow for two-way data packet communications" and that "the 'node' is not precluded from *also having the capability* of operating on the telephone network." J.A.70-71, 72 (*Markman* Order at 14-15, 16 (emphasis added)).

- A "pager" here "could, for example, transmit certain data communications on a paging system that 'operates independently

> from [the] telephone system, *while engaging in other types of communications on the telephone system*." J.A.73 (emphasis added).
>
> - The phrase "operates independently" means only "that the system can return a 'data communication or a 'page call' without accessing the telephone system, and *does not necessarily mean that the system and/or individual pager units cannot have any interaction with the telephone system*." J.A.74-75 (emphasis added).

Yet, exactly as GPNE predicted, Apple sought summary judgment of non-infringement on the basis that the claims covered legacy "pagers" (*i.e.*, "small wearable devices used to send and receive short messages," J.A.44356 (Apple's MSJ at 2) and "paging systems" (i.e., "simulcast technology, using multiple high powered transmitters to send the same message to a single pager" that is "broadcast through other transmitters many miles away at very high power," J.A.44359 (*id.* at 5). Apple argued that its iPhones and iPads could not be "pagers," nor could data networks like GPRS or LTE be "paging systems," because they operated using modern cellular techniques to transmit data packets. *See also* J.A.44357 (*id.* at 3) ("Plaintiff was trying to read old-pager patents on modern-day smartphones."); J.A.44358 (*id.* at 4) ("pagers are not cell phones (and vice versa)").

The district court disagreed with Apple—again—and denied Apple's motion for summary judgment, explicitly rejecting Apple's argument that the use of the word "pager" in the construction of the term "node" inherently excluded

smartphones and tablets or devices that send data over cellular networks such as GPRS or LTE:

> GPNE thus contradicts Apple's evidence with substantial evidence of its own showing that ***iPhones and iPads can be considered 'pagers' in addition to smartphones and tablets***. As such, GPNE presents sufficient evidence for a reasonable jury to conclude that the accused devices are 'pagers.' Especially in light of Apple's suggestions at the Markman hearing that whether the accused devices are 'pagers' is an 'issue of fact' and that 'pager' can be defined in the context of whether the device can communicate on a network independent of the telephone system... summary judgment of non-infringement on 'pager' is improper.

J.A.4130 (MSJ Order at 10) (emphasis added). In yet another order on *Daubert* motions, the court again repeated that its use of "pager" and other paging terms did not limit the claims to legacy paging networks and could instead include modern data networks like GPRS and LTE: "[The Court] found in its claim construction order that the Patents-in-Suit relate primarily to pager technology, *which is just one aspect of 3G and 4G LTE technology.*" J.A.4231 (*Daubert* Order at 9).

Before trial, the district court clearly did not intend to limit the scope of the term "node" or "pager" to just legacy pagers capable of sending only "short, critical messages" over "simulcasting" technology. Apple, however, successfully sought via a motion *in limine* to preclude GPNE from referencing these statements in the court's order at trial. J.A.4359 (Apple Motion *in Limine* No. 2); J.A.5248-49 (Pretrial Order Re: Motions *in Limine*). Thus, the district court's scope clarifications were never explained to the jury. By just using the term "pager" in

the construction of node, without any further explanation as to what that term meant to persons of skill in the art at the time of the invention after reading the disclosure, the district court left the term open to misinterpretation at trial. And that is exactly what happened.

B. The Parties Disputed the Scope of the Term "Pager" at Trial

By the time of trial, there was no dispute that despite the statements by the district court clarifying the construction, the entire trial was about one question: "what is a pager?" Counsel for Apple spent the vast majority of its opening statement holding up an old Motorola device and using it to define the terms "pager" and "paging system"—even suggesting that the district court had *agreed* with Apple's definitions—without ever showing the jury the positions the district court had *actually* taken:

- "Cell phones were alive and well and in existence in 1994. The patent itself talks about this. The patent itself says that cell phones were in existence. The patent, in the first couple of paragraphs, talks about other people who had done paging systems over a cell phone. And these inventors said, over and over again, that ***our invention is about a pager. It's not about a cell phone.***" J.A.6687 (Apple's Opening Statement, Trial Tr. at 193).

- "[A] ***pager us[es] a very low data rate*** of bits per second, hundreds of, or perhaps even a key bit per second, but low data rate." J.A.6705 (*id.* at 211).

- "[T]he iPhones and iPads ***do not fit Judge Koh's paging system definitions***. . . . [A] paging system has fairly high radiating power. . . . [It] essentially screams out the information across the whole

> industry, and whatever pagers happen to be able to pick it up they can. But it's sort of a brute force approach." J.A.6704-06 (*id.* at 210-212).
>
> - "***A pager, we all know, allows you to get a signal in a basement or an elevator***. . . . Anybody who's been in an elevator or basement knows the phone doesn't work so good." J.A.6706 (*id.* at 212).
>
> - "The ***data that the pager sends***, again, it's very modest, and the way they send it***, the frequencies they use*** and the coding systems they use will penetrate, ***they're very simple*** . . . ." J.A.6707 (*id.* at 213).
>
> - "What Dr. Wilson concluded is, in fact, that [paging systems and telephone networks] operate in a completely different way, that they don't provide the same function at all, a – ***a pager is designed to take short, very low data messages, very reliable, long battery life, compact in size***." J.A.6709 (*id.* at 215).
>
> - "GPNE wasn't sticking to their pager patent and was stretching their claims. They wanted to cover other technology like cell phones. The problem is cell phones existed before GPNE came along. . . . ***When they stretch the claims, they're not remaining true to their patents anymore.***" J.A.6710 (*id.* at 216).

Apple spent only *forty seconds* of its forty-minute opening statement mentioning any claim limitation other than the term "node" and "pager." *See* J.A.6704, 6710. Instead, the jury was told to focus almost entirely on the word "pager" and what it meant.

In response to Apple's statements at opening that this trial would be about the scope of the term "pager," GPNE attempted to have its expert, Dr. Esmael Dinan, explain what GPNE thought the court had already held: persons of skill in the art at the time of the invention, upon reading the patent disclosure and history,

would understand that the term "pager" meant a device capable of sending data packets on a data network. J.A.27969-70 (Trial Tr. at 515-16). GPNE then devoted the bulk of Dr. Dinan's testimony to showing how the accused devices met each claim limitation in detail as described further below. *See infra*, Section IV. In response to Dr. Dinan's testimony, Apple argued to the jury that Dr. Dinan lacked credibility precisely because he argued the scope of the term "pager" was broader than the definition being advocated by Apple.[5] Apple asked its own invalidity expert: "Do you recall the iPad I'm holding up as DTX355, [Dr. Dinan] said this is a pager? . . . . Did you wonder how big his belt is?" J.A.29080 (Trial Tr. at 1353).

Apple kept the entire trial about the scope of the term "pager," barely even touching the other claim elements.[6] Dr. Kate Wilson spent more than an hour and a

[5] The district court found that the jury may have questioned Dr. Dinan's credibility not because he was ever impeached or made any contradictory statements, but because he said Apple's questions about how legacy pagers operated were "irrelevant." J.A.33-34 (JMOL Order at 32-33). This testimony does not in any way impugn Dr. Dinan's credibility; rather, it is further evidence of Apple's repeated efforts to keep the scope of the "pager" at the front of the jurors' minds.

[6] Apple asked virtually every witness to weigh in on the scope of the word "pager," whether they had technical expertise or not. *See, e.g.*, J.A.6793-94 (Apple questioning Gabriel Wong about whether he agreed that "pagers" typically have batteries lasting four to six weeks); J.A.6904 (Apple asking Edwin Wong, the CEO, whether "pagers" differed from cell phones); J.A.28670-72 (Apple asking GPNE's damages expert, Michael Dansky, whether a legacy Motorola pager was "a pager within the meaning of the claims"); J.A.28805-06 (Apple's corporate representative, Frank Casanova, explaining that no one has ever called an iPhone

half of her roughly two hours of testimony on the meaning of the term "pager," "paging system," and what it meant to operate independently of a telephone network—all related to the scope of the term "node." J.A.28855-931. In her words, pagers had certain "requirements," such as having "low data rate" and "high radiated power" via simulcasting on a set of frequencies designated by the FCC. J.A.28874; J.A.28965. Under her definition, "pagers are relatively passive compared to cell phones. Cell phones are always anxiously trying to figure out which cell to go to next. That's one of the reasons we call it a cell phone. And that's one of the reasons they drain power so much. But ***pagers don't do that***." J.A.28861. Dr. Wilson cited the patents as showing that the node in the claims "is a much simpler device than a cellular phone." J.A.28862; J.A.28872 ("Pagers have different purposes than cellular systems. ***Pagers are designed for short, critical messages*** . . . . Cellular telephones are designed for flexibility. . . ." (emphasis added)).

Dr. Wilson was also asked to interpret the prosecution history—a task usually reserved for the court—and whether she found "any further discussion in these prosecution histories that *distinguish* paging systems from cellular phone networks." J.A.28864. Dr. Wilson pointed to the Rule 131 declaration from

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"a pager" and that there was a "fundamental difference" between phones and pagers").

Gabriel Wong to argue that "GPNE tried to distinguish themselves from a telephone system, from a cellular telephone system, and that's how they wanted to get their patent. They wanted to distinguish themselves from the prior art, which was telephony, and say, no, we're a paging system." J.A.28866-67. Under Apple's definition of the term "pager," pagers and cell phones have "differing designs, different purposes, different designs, different applications." J.A.28873. Dr. Wilson detailed at length the differing design and function between pagers and cell phones under her narrow definition of pager. J.A.28874. Paging systems and cellular data networks, pagers and cell phones, were "totally different animals." J.A.28892.

Yet despite this testimony from Dr. Wilson seeking to narrow the term node by giving pager a limited meaning, Apple's invalidity expert, Peter Rysavy, agreed that he gave the term "pager" *a broader scope* when considering the validity of the patents. Mr. Rysavy testified that he did not apply the Court's claim construction and that in his view, if GPNE's patents were given the narrower scope advocated by Apple, then GPNE's patents are valid. J.A.29029 (Rysavy's Testimony); J.A.29488 (Apple's Closing Statement) ("If they will stick to the fact that they have patented a pager, then the patent is valid."). But on the other hand, "if GPNE tries to stretch its claims, its pager claims to cover cell phones," then they are not valid. J.A.29029; *id.* ("My assignment was to determine if . . . GPNE's pager

patents were valid if they were stretched to cover cell phones."); J.A.29112-14 ("if you stretch the pager claims to cover phones, then the GSM is prior art."). Mr. Rysvay's failure to use the same construction to evaluate validity as his counterpart Dr. Wilson did for infringement violates basic tenets of patent law. *See, e.g.*, *TiVo, Inc. v. Echostar Communications Corp.*, 516 F.3d 1290, 1311 (Fed. Cir. 2008) (affirming exclusion of expert testimony that was based on infringement expert's "view of the claims" rather than how the prior art related to the claims as construed); *Helifix, Ltd. v. Blok–Lok, Ltd.*, 208 F.3d 1339, 1346 (Fed.Cir. 2000) (invalidity requires "a comparison of the construed claims to the prior art.") (emphasis added). Apple's "stretching" arguments only underscore Apple's blatant efforts to ask the jury to engage in construing claim scope—and to do so differently when adjudging infringement and validity.

Despite all of the above, the district court concluded that "[t]he only times the jury was told about legacy 'beepers' was argument from GPNE's counsel and evidence from GPNE's expert, Dr. Dinan." J.A.22 (JMOL Order at 21). Such a statement is plainly contrary to the record from trial. GPNE spent no more than two minutes of its forty-minute opening statement on the term pager, during which counsel informed the jury what GPNE thought had already been decided—that the patents, although using the term "pager," are not limited to "very old-fashioned beepers that you used to clip on" and "are not limited to a simple beeper-type

device." J.A.6677. To the extent it matters, and as discussed below in Section III.D it does not, it was Apple and not GPNE that made the trial about claim scope.

C. The Jury Cannot Resolve Questions of Claim Scope

It cannot be reasonably disputed that this jury was asked to decide the meaning of the term pager. As the above testimony demonstrates, both sides offered competing positions as to the scope of the term "pager." Courts, however, and not juries, must "resolve disputes about claim terms and [] assign a fixed, unambiguous, legally operative meaning to the claim." *Liquid Dynamics Corp. v. Vaughan Co.*, 355 F.3d 1361, 1367 (Fed. Cir. 2004). Arguing claim construction to the jury is inappropriate because it risks confusion and the likelihood that a jury will render a verdict not supported by substantial evidence." *CytoLogix Corp. v. Ventana Med. Sys., Inc.*, 424 F.3d 1168, 1173 (Fed. Cir. 2005)).

The district court erred by not presenting the jury with a fixed, unambiguous meaning for the claim term "node." In *O2 Micro*, this Court held that the district court erred in failing to construe the claim limitation "only if" and allowing the parties to submit their dispute over its scope to the jury. The parties presented expert testimony and argument to the jury "regarding whether or not the 'only if' claim language allowed exceptions." *Id.* at 1365. Because the parties had a "fundamental dispute regarding the scope of a claim term," the district court erred as a matter of law in failing to resolve it. *Id.* at 1362. It did not matter that, for

example, the parties had agreed that the term had a common meaning. *Id.* at 1361. They "then proceeded to dispute the scope of that claim term [at trial], [and] each party provid[ed] an argument identifying the alleged circumstances when the requirement specified by the claim term must be satisfied." *Id.* This was legal error.

Similarly, in *Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1313 (Fed. Cir. 2003), the Federal Circuit reversed a district court's denial of JMOL after the jury returned a verdict of non-infringement. The district court had construed a term "guiding steps" but "left undetermined whether the claim requires sequential performance of the steps." Although the Court's claim construction and instructions to the jury did not require sequential performance, the testimony could have led the jury to reach that conclusion. This was improper: "[T]he district court allowed the jury to add an additional limitation to the district court's construction of 'guiding steps.' In this, the district court erred. Claim construction is a question of law and is not the province of the jury." *Id.* Without the improper narrowing of the claim term, all of the evidence supported infringement and judgment as a matter of law was appropriate despite the jury verdict. *Id. Cf. Every Penny Counts, Inc. v. Am. Express Co.*, 563 F.3d 1378, 1383 (Fed. Cir. 2009) (holding district court correctly adopted a fixed meaning to a word used in a construction because if it had it not, "then it would quite clearly have failed to assign 'a fixed, unambiguous, legally operative meaning to the claim'").

The district court distinguished *O2 Micro* and *Moba* by interpreting the testimony at trial as the application of a "fixed" and "unambiguous" construction of the term "node" to the accused devices. But the above testimony cannot so easily be swept aside. Apple offered substantial testimony explicitly about *what a pager is*, not just whether the Apple devices were one: "[a] pager us[es] a very low data rate of bits per second, hundreds of, or perhaps even a key bit per second, but low data rate," J.A.6705, "***a pager is designed to take short, very low data messages, very reliable, long battery life, compact in size***," J.A.6705, "pagers don't do that," J.A.28861, "[p]agers have different purposes than cellular systems. Pagers are designed for ***short, critical messages***," J.A.28872. The dispute over the scope of the term "pager" is exactly what this Court has held should not be sent to a jury.

It was legal error for the district court to fail to resolve this dispute and instead ask the jury to decide. "There are times when we need to interpret interpretations more than to interpret things." *Every Penny*, 563 F.3d at 1383 (internal citation and quotation omitted). This was one of those times. Because the issue of whether the iPhones and iPads were "pagers" so permeated the trial, the judgment must be reversed.

D. GPNE Was Not Required to Seek a Construction-Within-a-Construction to Preserve Its Arguments and Did Not Waive Them Under *O2 Micro*

The district court held that GPNE waived its objections to the use of the term "pager" within the construction of the term "node" because GPNE failed to seek a construction of the term-within-the-construction. J.A. 11-14 (JMOL Order at 10-13). The district court also concluded that GPNE waited too long to bring the ambiguity in the term "pager" to the district court's attention. Even if GPNE could waive an *O2 Micro* argument, and it cannot, none of GPNE's actions amounted to waiver.

As an initial matter, GPNE could not have waived its argument under *O2 Micro* that the court and not the jury must decide claim scope. This Court has made clear that "parties cannot argue conflicting claim constructions to the jury even by agreement" even when "the district court makes it clear to the jury that the district court's claim constructions control." *Cytologix Corp. v. Ventana Med. Sys., Inc.*, 424 F.3d 1168, 1172 (Fed. Cir. 2005). Even if GPNE had affirmatively acquiesced in presenting this dispute to the jury, which it did not, the argument would be properly considered on appeal.

In fact, GPNE affirmatively objected at multiple times in the litigation not just to the use of the term "pager" but to asking the jury to resolve its scope. The district court faulted GPNE for not seeking a construction of the term "pager,"

within "node," but GPNE is aware of no case, and the district court cited none, requiring a party to affirmatively seek a construction of a term-within-a-construction where the party had expressly advocated against the challenged term at *Markman*. It is enough that GPNE argued for a different scope at *Markman*. *See Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 381 F.3d 1371, 1380-81 (Fed. Cir. 2004) ("When the claim construction is resolved pre-trial, and the patentee presented the same position in the *Markman* proceeding as is now pressed, a further objection to the district court's pre-trial ruling may indeed have been not only futile but unnecessary." (applying Seventh Circuit law)); *see also CollegeNet*, 418 F.3d at 1234 (holding party did not waive appeal of claim construction by not objecting to jury instructions because party was seeking same construction that district court had rejected during Markman).

According to the district court, GPNE was required to raise any concerns about the term "pager" in the construction of node at (1) Markman, (2) in the Joint Pretrial Statement, (3) jury instructions. As already discussed, GPNE *did* raise concerns about the scope of the term "pager" at *Markman*. J.A.510 (GPNE Markman Br. at 4). The district court also seemed concerned but ultimately was assured by Apple that the jury would be told there was "more to it than just a pager." J.A.1571. The district court is correct that GPNE did not re-raise this issue in the joint pretrial statement or in the initial round of jury instructions, but at the

time of those submissions, in July 2015, two months before trial, GPNE had no way of knowing Apple was going to re-argue the scope of the term "pager" to the jury, particularly in light of the district court's repeated statements that the word "pager" did not have the scope urged by Apple. As soon as it became apparent, GPNE raised the issue promptly and in all three subsequent jury instructions. *See* J.A.7128-35 (Third Amended Joint Jury Instructions, Instruction No. 21, 10/13/14); J.A.26273-77 (GPNE's Objections to Jury Instructions, 10/19/14); J.A.26594-96 (GPNE's Objections to Jury Instructions, 10/21/14).[7]

Once raised at *Markman*, GPNE was not obligated to continue objecting repeatedly to the word "pager" after the court had already ruled. *See Ecolab, Inc. v. Paraclipse, Inc.*, 285 F.3d 1362, 1369-70 (Fed. Cir. 2002) (noting that "a general rule has evolved that [a] litigant is excused from complying with the strict objection requirement of Rule 51 if the district court is aware of the party's position and it is plain that further objection would be futile, where [the] litigant's position [was] clearly made to the district court" (alterations in original and quotation marks omitted)); *O2 Micro*, 521 F.3d at 1359 (holding that "no objection

[7] The district court required the parties to propose and brief their objections to the jury instructions on six separate occasions, three of which were in the middle of trial, presumably to take into account issues as they developed at trial. *See* June 19, 2014 (ECF No. 316), June 25, 2014 (ECF No. 320), July 15, 2014 (ECF No. 335), October 13, 2014 (ECF No. 461), October 19, 2014 (ECF No. 505), October 21, 2014 (ECF No. 536).

to the jury instruction was required to preserve error" of erroneous claim construction); *CollegeNet*, 418 F.3d at 1234 (holding no waiver of appeal of claim construction argument despite failure to object to jury instructions, applying Ninth Circuit law); *see also Lighting Ballast Control LLC v. Philips Electronics N. Am. Corp.*, 790 F.3d 1329, 1337 (Fed. Cir. 2015) (holding no waiver; "ULT was not required to object to claim construction under Rule 51 after ULT made its claim construction position clear to the court and the court rejected it.").

To support waiver for not seeking a construction of a term-within-the-construction, the district court cites only *Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1320–21 (Fed. Cir. 2003). This case is inapposite. *Hewlett-Packard* held that the district court erred in not granting JMOL to reverse a jury verdict of infringement. The district court had instructed the jury as to the meaning of a claim term, and "[n]either party objected." *Id.* at 1320. In seeking a JMOL, the defendant then argued that the term should have a *different* meaning. This Court disagreed and held that JMOLs are not the time to make *more detailed constructions*: "[T]he parties cannot reserve issues of claim construction for the stage of post-trial motions. When issues of claim construction have not been properly raised in connection with the jury instructions, it is improper for the district court to adopt a new or more detailed claim construction in connection with the JMOL motion." *Id.* Nowhere in *Hewlett-Packard* does the Court require that parties seek a

construction-within-a-construction to prevent waiver of their initial arguments at claim construction.

IV. The District Court Erred by Denying GPNE's JMOL Motion

No reasonable jury could find against GPNE on its claims of infringement. GPNE offered hours of unrebutted testimony from Dr. Dinan demonstrating how each of the accused devices satisfied each limitation of each Asserted Claims. He explained three different bases for his opinion that Apple's GPRS-compatible devices (models A1332, A1387, A1328, A1396, A1430, and A1454) meet every element of Claim 44 of the '492 and Claims 19 and 22 of the '954. First, Dr. Dinan walked through how the GPRS standard incorporated (and indeed required) the use of each limitation of the GPNE claims in order for devices to operate on GPRS networks. J.A.28045-28056. Next, he confirmed that to be sold as GPRS-compatible devices in the open market, the Apple devices would have to undergo compliance testing that would confirm their usage of every limitation in the two-phase reservation protocol called for by the claims. J.A.28066-28075.[8] And finally, Dr. Dinan personally confirmed that the Apple devices made use of each limitation

[8] GPNE's second expert, Dr. Neil Birkett, confirmed that Apple devices passed these tests. J.A.28127 (Dinan Testimony); J.A.28181-83 (Birkett Testimony). Because of Dr. Dinan's own patents in this space, Dr. Dinan was not able to agree to a prosecution bar and thus could not view Apple's internal compliance documents in this case. Dr. Birkett, however, did review these documents, and confirmed their results.

by testing them on a network emulator that could simulate sending and receiving messages over GPRS. J.A.28078-107 (Testimony by Dr. Dinan about PTX137); *see also* J.A.32571-72 (PTX 137 Call Log from Agilent Test, lines 1050-79); J.A.34051 (*id.* at Message 1050); J.A.34054 (*id.* at Message 1053); J.A.34070 (*id.* at Message 1066).

For the LTE-compatible devices (models A1429, A1403, and A1455), Dr. Dinan testified that he applied the same first two steps of his analysis and reached the same results, including that they infringe Claim 22 on this separate basis. J.A.28056-65 (discussing LTE standards); J.A.28075-78 (discussing LTE test cases); J.A.28107-111 (discussing infringement). When Dr. Dinan was cross-examined, he was asked almost entirely about his views of an old Motorola pager and the scope of the claim construction itself. J.A.28116-28122.

Apple had fifteen hours of testimony, and of it, spent only thirty-six minutes dealing with any of the non-node limitations of the claims. Apple's cursory arguments relating to count value, aligning signal, and four frequencies requirements—many of which themselves piggy backed on Apple's same, improper claim scope arguments—are insufficient to support the jury verdict.

For the "information relating to count value" limitation, the district court concluded that Dr. Wilson's testimony supported a finding that "the GPRS countdown does not transmit the total number of consecutive packets in the

transmission to the receiver." J.A.45 (JMOL Order at 33). But this conclusion does not support non-infringement because the claims do not require the transmission of the total number of packets itself; instead, they require transmission of "information *relating to* a count value," *i.e.*, information relating to the total number of data packets." Apple failed to dispute this point.

For the aligning signal, the district court held that Dr. Wilson's testimony on this point was sufficient primarily based on her statements that the GPRS signal was a "telephone signal" because it is also used in circuit-switching technology. J.A.45 (JMOL Order at 44). Because the construction of "node" was incorrect, this argument is insufficient to support a finding of non-infringement.

For the "differing frequencies" limitation, Dr. Wilson's testimony confirmed that the signals were sent on up to 72 differing frequencies, which is all that Claim 22 (the claim that the LTE-enabled devices were accused of infringing)[9] required. J.A.48-49. The district court did not dispute that the signals were sent on differing frequencies, but held that Dr. Wilson was allowed to treat the "differing

[9] The district court also held that GPNE had waived its arguments for the GPRS-enabled devices because its JMOL motion only addressed the LTE devices on this point. This was because at trial, Apple failed to offer any evidence the frequency limitation for the GPRS devices entirely. GPNE's opening JMOL Motion cited the affirmative testimony by Dr. Dinan demonstrating that each device (both the GPRS- and LTE-enabled) satisfied the limitations. GPNE Brief at 24. GPNE was not required to refute evidence that Apple had never presented at trial to avoid waiver.

frequencies" requirement in Claim 22 as coextensive with the "differing frequency" requirement in Claim 44 because Dr. Dinan supposedly did. Not so. Dr. Dinan explained why the scope of Claim 22 and Claim 44 differed in this regard, and how the use of more than four frequencies—which Dr. Wilson did not dispute—satisfied this limitation. J.A.29285. Dr. Wilson's cursory testimony on this point, and as to the wrong claim limitation, cannot sustain a finding of non-infringement.

In light of the ample evidence supporting GPNE's infringement position on every single limitation in the claims, and Apple's complete lack of evidence on these limitations aside from improper arguments about claim construction, judgment as a matter of law in favor of GPNE on infringement is proper. *See, e.g.*, *Transmatic. Inc. v. Gulton Industries*, 53 F.3d 1270, 1278 (Fed. Cir. 1995) (reversing finding of non-infringement because "patentee clearly did not intend to limit the definition of [a claim term] in the manner suggested by the district court" and also because "[d]ifferences in the way the patented invention and accused device function . . . are not legally relevant to whether [the accused] device falls within the literal language of the asserted claim."); *see also Callicrate v. Wadsworth Mfg., Inc.*, 427 F.3d 1361, 1363 (Fed. Cir. 2005) ("[S]ubstantial evidence does not support the jury verdict of no infringement, this court also reverses that verdict and remands for a trial on damages.").

V. The District Court Abused Its Discretion by Denying GPNE's Motion for New Trial

A new trial is proper where, on the record, the jury's verdict resulted in a miscarriage of justice or cries out to be overturned. In assessing a motion for a new trial, the Court must reweigh the evidence independently of the jury's verdict.

Here, the district court's "review" of the record ignored the great weight of testimony in favor of infringement and excused numerous impermissible arguments by Apple. As discussed above, GPNE established a prima facie case of infringement, which Apple failed to rebut with any substantive evidence. Dr. Dinan's testimony on the claim limitations was credible and unimpeached. Apple's entire non-infringement argument was that the patents applied only to legacy pagers, and that its devices were not legacy pagers. Thus, the jury's verdict rests on an impermissible standard for finding non-infringement. On this record, GPNE is entitled to a new trial.

CONCLUSION

For all of the foregoing reasons, Plaintiff-Appellant GPNE respectfully requests that this Court reverse the entry of judgment in favor of Apple and enter judgment of infringement in favor of GPNE, or alternatively remand for further proceedings.

Dated: October 14, 2015 Respectfully submitted,

/s/ Kalpana Srinivisan

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Counsel for Plaintiff-Appellant and Cross-Appellee GPNE Corp.

CERTIFICATE OF SERVICE

I, Kalpana Srinivasan, a member of the Bar of this Court, hereby certify that on October 14, 2015, a copy of **OPENING BRIEF FOR APPELLANT GPNE** was served by electronic filing via CM/ECF and by e-mail on the following persons:

Counsel for Appellee-Defendant Apple, Inc.

Dated: October 14, 2015

By: */s/ Kalpana Srinivasan*

Kalpana Srinivasan

Counsel for Appellant GPNE

CERTIFICATE OF COMPLIANCE

Pursuant to Federal Rules of Appellate Procedure 28.1(e)(3) and 32(a)(7)(C), the undersigned hereby certifies that this brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 28.1(e)(2)(B)(i).

1. This brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 28.1(e)(2)(B)(i) and Federal Circuit Rule 32(b) because this brief contains 13,877 words, excluding the parts of the brief exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b)(1)-(3).

2. This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6) because this brief has been prepared in a proportionally spaced typeface using Microsoft Word 2010 in 14-point Times New Roman Font.

Dated: October 14, 2015

s/ Kalpana Srinivasan

Counsel for Plaintiff-Appellant and Cross Appellee

INDEX TO ADDENDUM

Exhibit 1

United States District Court
Northern District of California

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

GPNE CORP.,

Plaintiff,

v.

APPLE INC, et al.,

Defendants.

Case No. 12-CV-02885-LHK

JUDGMENT

This action came before the Court for a trial by jury. The issues have been tried and the jury rendered its verdict in favor of Defendant on October 22, 2014. The Court denied Plaintiff's motion for judgment as a matter of law or alternatively, a new trial on June 9, 2015. Accordingly, the Clerk of the Court shall enter judgment in favor of Defendant. The Clerk shall close the file.

IT IS SO ORDERED.

Dated: June 10, 2015

Lucy H. Koh

LUCY H. KOH
United States District Judge

Exhibit 2

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

GPNE CORP.,

Plaintiff,

v.

APPLE INC.,

Defendant.

Case No.:12-CV-02885-LHK

ORDER DENYING GPNE'S MOTION FOR JUDGMENT AS A MATTER OF LAW, OR FOR A NEW TRIAL; DENYING APPLE'S MOTIONS FOR JUDGMENT AS A MATTER OF LAW

Re: Dkt. Nos. 572, 574, 575

On October 22, 2014, after seven days of trial and four and a half hours of deliberation, a jury concluded that Defendant Apple, Inc. ("Defendant" or "Apple") did not infringe two patents owned by Plaintiff GPNE Corp. ("Plaintiff" or "GPNE"), and that GPNE's patents were not invalid. *See* ECF No. 559 (Jury Verdict).

Before the Court are the parties' post-trial motions. Specifically, GPNE seeks judgment as a matter of law on infringement, or in the alternative, a new trial. ECF No. 572 (GPNE JMOL Br.). Apple seeks judgment as a matter of law on its indefiniteness defense. ECF No. 574 (Apple

Indefiniteness JMOL).[1] For the following reasons, the Court DENIES each of the parties' requests.

I. BACKGROUND

A. Asserted Patents

GPNE alleges that Apple infringes U.S. Patent Nos. 7,570,954 (the "'954 Patent"), and 7,792,492 (the "'492 Patent") (collectively, "Asserted Patents").[2] The Asserted Patents share the same specification, which provides that the "invention pertains to communications paging, and particularly to two-way paging method and apparatus." '492 Patent at 1:32–33; *see also id.* at 1:66–67 (describing "[a] two-way paging system [that] utilizes four local frequencies for transmissions . . . ."). The specification describes the use of "four local frequencies for transmissions between pager units and a central control station." *Id.* at 1:66–2:1. As set forth in the specification, frequencies one and two are used to transmit downstream, from the control station to the paging unit, while frequencies three and four are used to transmit upstream, from the paging unit to the control station. *See id*. at 1:66–2:9. This four frequency system enables two-way data communications between the paging unit and the control station. *Id*. at 1:66–2:9.

GPNE accuses nine Apple products of infringing the Asserted Patents. The accused Apple devices, certain models of Apple iPhones and iPads, allegedly infringe based on their compatibility with General Packet Radio Service ("GPRS") and Enhanced Data rates for GSM Evolution ("EDGE") networks,[3] and/or Long-Term Evolution ("LTE") networks. GPRS, EDGE,

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[1] Apple also filed a conditional motion for judgment as a matter of law as to obviousness. Apple requests that the Court address this motion only in the event that the Court grants GPNE's motion for judgment as a matter of law or for a new trial. *See* ECF No. 575 (Apple Obviousness JMOL), at 1. As the Court denies GPNE's motion in its totality, the Court also DENIES Apple's conditional motion as moot.

[2] GPNE had also alleged infringement of U.S. Patent No. 7,555,267 (the "'267 Patent"), but chose not to continue to assert the '267 Patent two weeks before trial. *See* ECF No. 411 ("On September 24, 2014 . . . GPNE sua sponte informed Apple and the Court that GPNE would voluntarily drop 2 asserted patent claims for trial."). The '267 Patent also shares the same specification as the Asserted Patents.

[3] EDGE utilizes GPRS signaling, and therefore evidence as to GPRS functionality also applies to EDGE.

and LTE are standards for cellular communications promulgated by the telecommunications standard setting associations 3GPP and ETSI. According to GPNE, these communications standards rely on the two-way paging system disclosed in the Asserted Patents, and the accused devices' compatibility with these standards renders the accused Apple devices infringing.

B. Procedural Background

This litigation began in May 2012, when GPNE filed a complaint in the District of Hawaii against fifteen separate defendants, including Apple.[4] ECF No. 1 (Compl.). Subsequently, the District Court in Hawaii severed GPNE's cases against each of the defendants in the Hawaii action and transferred several of the separate actions to this District. *See, e.g.*, ECF Nos. 246, 295; *GPNE Corp. v. Nokia Corp.*, Case No. 12-CV-00250 SOM RLP, ECF No. 14; *GPNE Corp. v. Pantech Co., Ltd. and Pantech Wireless, Inc*., Case No. 12-CV-00251 SOM RLP, ECF No. 10; *GPNE Corp. v. Amazon Inc.*, Case No. 12-CV-00426 SOM-RLP, ECF No. 295; *GPNE Corp. v. Barnes & Noble, Inc.*, Case No. 12-CV-00249 SOM-RLP, ECF No. 246.

After holding a tutorial and claim construction hearing on June 6, 2013, this Court issued an order construing disputed claim terms. *See* ECF No. 87 (Order Construing Claims). On February 27, 2014, Apple moved for summary judgment of noninfringement and invalidity. ECF No. 187. The Court held a hearing on Apple's motion for summary judgment on April 3, 2014. On April 9, 2014, the Court granted Apple's motion for summary judgment of noninfringement as to indirect infringement, and denied as to direct infringement. ECF No. 239 (Order on Summary Judgment). The Court also granted Apple's motion for partial summary judgment of invalidity as to claims 13, 18, 30, 31, and 39 of the '267 Patent for lack of written description and enablement. *Id.* at 22.

[4] In its original complaint, GPNE named as defendants: Amazon.com, Inc.; Apple Inc.; Barnes & Noble, Inc.; Garmin Ltd.; Garmin International, Inc.; Nokia Corp.; Nokia, Inc.; Pantech Co., Ltd.; Pantech Wireless, Inc.; Research in Motion Ltd.; Research in Motion Corp.; Sharp Corp.; Sharp Electronics Corp.; Sony Ericsson Mobile Communications AB; and Sony Ericsson Mobile Communications (USA), Inc. *See* Compl. at 2.

Trial began on October 6, 2014. At trial, GPNE presented the following experts: Dr. Esmael Dinan, Dr. Neil Birkett, and Michael Dansky. Dr. Dinan was GPNE's sole infringement expert. Dr. Birkett testified as to the components and capabilities of the accused products, including Cetecom testing. Mr. Dansky was GPNE's damages expert.

Apple presented the following experts: Dr. Sarah Wilson, Peter Rysavy, and Paul Meyer. Dr. Wilson testified as to noninfringement. Mr. Rysavy testified as to Apple's defenses of obviousness and invalidity. Mr. Meyer was Apple's damages expert.

The trial lasted seven days, and the jury deliberated for four and a half hours before returning a verdict. The jury found that none of the accused Apple products infringed Claim 44 of the '492 Patent or Claims 19 and 22 of the '954 Patent. *See* Jury Verdict. The jury also found the claims to be not invalid. *Id.*

II. LEGAL STANDARD

Rule 50 permits a district court to grant judgment as a matter of law "when the evidence permits only one reasonable conclusion and the conclusion is contrary to that reached by the jury." *Ostad v. Oregon Health Sciences Univ.*, 327 F.3d 876, 881 (9th Cir. 2003). A party seeking judgment as a matter of law after a jury verdict must show that the verdict is not supported by "substantial evidence," meaning "relevant evidence that a reasonable mind would accept as adequate to support a conclusion." *Callicrate v. Wadsworth Mfg.*, 427 F.3d 1361, 1366 (Fed. Cir. 2005) (citing *Gillette v. Delmore*, 979 F.2d 1342, 1346 (9th Cir. 1992)). The Court must "view the evidence in the light most favorable to the nonmoving party . . . and draw all reasonable inferences in that party's favor." *See E.E.O.C. v. Go Daddy Software, Inc.*, 581 F.3d 951, 961 (9th Cir. 2009) (internal quotations and citations omitted).

A new trial is appropriate under Rule 59 "only if the jury verdict is contrary to the clear weight of the evidence." *DSPT Int'l, Inc. v. Nahum*, 624 F.3d 1213, 1218 (9th Cir. 2010). A court should grant a new trial where necessary "to prevent a miscarriage of justice." *Molski v. M.J. Cable, Inc.*, 481 F.3d 724, 729 (9th Cir. 2007).

III. GPNE'S MOTION FOR JUDGMENT AS A MATTER OF LAW, OR IN THE ALTERNATIVE, A NEW TRIAL

GPNE makes several arguments in support of its motion for judgment as a matter of law, or, in the alternative, a new trial. GPNE first argues that the Court made five errors related to the claim term "node." GPNE then argues that Apple did not present substantial evidence of noninfringement on the "independent paging network" aspect of "node," or on the following limitations: "count value," "clocking/aligning signal," or "differing frequencies." In addition to responding to these arguments, Apple also contends that the jury could have reasonably discredited Dr. Dinan's testimony and concluded that GPNE failed to satisfy its burden of proof as to infringement. The Court addresses each argument in turn, beginning with GPNE's "node" arguments.

A. GPNE's Arguments Related to "Node"

GPNE's five arguments related to the term "node" are that: (1) the Court failed to properly construe the term "node"; (2) the Court left the scope of the term "node" to the jury, in violation of *O2 Micro*[5]; (3) Apple made improper arguments to the jury about the scope of the term "node"; (4) Apple argued that the jury could apply a "person on the street" standard to the jury's infringement determination; and (5) the Court failed to properly instruct the jury regarding claim construction. GPNE JMOL Br. at 9–10. Apple disputes that there was any error with regard to "node," argues that certain of GPNE's arguments were waived, and finally argues that even if the Court erred with respect to "node," GPNE's motion should be denied. The Court addresses each argument in turn.

1. The Court Properly Construed the Claim Term "Node"

GPNE's first argument is that the Court's construction of the term "node" was improper. GPNE JMOL Br. at 9. The term "node" appears in each asserted claim, both in the preamble and in the body of the claim. For example, Claim 22 of the '954 Patent, which depends from claim 13,

[5] *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351 (Fed. Cir. 2008).

reads in pertinent part:

> 13. A first **node** in a data network, the data network including a plurality of **nodes** including a first **node**, the first **node** comprising:
>
> at least one processor;
>
> a memory providing code to the at least one processor; and
>
> an interface controlled by the at least one processor . . .
>
> 22. The first **node** of claim 13, wherein the interface is further controlled by the processor to:
>
> transmit randomly generated information created by the first **node**; and
>
> receive said randomly generated information returned from the communication controller to enable identification of the first **node**.

'954 Patent, cl. 13, 22 (emphases added).

In its claim construction briefing, GPNE proposed construing "node" as "a device in a network that can transmit and receive information." ECF No. 69 (Opening CC Br.) at 3. Apple proposed "a pager in a network operating independently of a telephone network." ECF No. 72 (Resp. CC Br.) at 4. The dispute over the term involved both (1) whether a node was limited to a pager and (2) whether the node must operate independently from a telephone network. Order Construing Claims at 9.

The Court construed the term "node" as a "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." Order Construing Claims at 9. GPNE argues that this construction errs in three respects: (1) the construction imports limitations from the specification; (2) the construction ignores the purpose of the invention; and (3) the construction violates principles of claim differentiation. GPNE JMOL Br. at 9–13. Apple argues that these arguments were waived, as GPNE failed to raise them in connection with the jury instructions, and that the Court's claim construction is correct. Apple Opp. at 13–14.

The Court first reviews the construction of "node," and concludes that the construction adopted at the *Markman* stage is correct. Next, the Court addresses Apple's waiver arguments, and concludes that (1) GPNE never sought construction of the terms "pager," "paging system," or "telephone network"; (2) GPNE waived two of the claim construction arguments it now asserts; and (3) GPNE never sought reconsideration of the Court's construction of "node," and instead consistently advocated for an overbroad construction.

a. The Court's Construction of "Node" is Correct

i. The Court correctly limited "node" to pagers

The Court correctly limited "node" to pagers. GPNE's primary argument at the *Markman* stage, and in its post-trial briefing, is that the invention is not limited to legacy one-way pagers. GPNE JMOL Br. at 11; Opening CC Br. at 4–5. The Court agreed, and construed "node" as a two-way pager with specific network independence characteristics. Order Construing Claims at 9. GPNE's contention that the Court limited node to pager "based entirely on the presence of the words 'paging unit' and 'pager' in the preferred embodiments" is both incorrect and unpersuasive. GPNE JMOL Br. at 12. As discussed in depth in the Court's *Markman* Order, the Court used the term "pager" within the construction of "node" for at least the following eleven reasons:

1. The term "node" appears only in the claims, abstract, and title of the Asserted Patents;

2. The term "node" does not appear anywhere in the original parent patent, U.S. Patent No. 5,542,115 (the " '115 Patent");

3. The term "pager" is used over 200 times in each Asserted Patent;

4. The Asserted Patents repeatedly refer to "the invention" or "this invention" as a "two-way paging" system. *See, e.g.*, '276 Patent at 1:32–33; 14:14–15;

5. The "Related Art" portion of the specification discusses problems with prior art one-way and two-way pagers. '267 Patent at 1:41–62;

6. The only exemplary embodiments in the specification describe "pager units." '267 Patent Figs. 2, 5, and 8.

7. The specification distinguishes pagers and cell phones. *Id.* at 5:31–35;

8. The specification provides no hint as to what a non-pager node could be;

9. The prosecution history refers to the invention as a pager with certain features that are indicative of a paging device in contrast to a cell phone or other device. ECF No. 72-10 at GPNECorp. 00000323 (discussing light weight, compact size, and low power consumption of the invention);

10. GPNE's expert, Dr. Dinan, testified that a person of ordinary skill would consider a "node" a "**pager type** apparatus enhanced with pre-programmed software and appropriate hardware to allow for two-way data packet communications through a central control station." ECF No. 69-6 (Dinan CC Decl.) ¶ 28 (emphasis added); and

11. At his deposition, Dr. Dinan further testified that the patent claimed an "enhanced **pager**." ECF No. 72-6 (Dinan CC Depo.) at 126:2 (emphasis added).

Order Construing Claims at 9–15 (discussing support of the construction of node as pager). Having reviewed the prior Order Construing Claims, the Court finds that GPNE does not present any convincing argument that the claimed nodes are not pagers with two-way data capability.

ii. The Court correctly limited node to devices that communicate "on a paging system that operates independently from a telephone network."

The Court correctly limited nodes to devices that communicate "on a paging system that operates independently from a telephone network." Order Construing Claims at 9. At the *Markman* stage Apple argued that a "node" could not be capable of use on a telephone network. *Id.* at 16. The Court disagreed, and acknowledged that while the claimed node could operate on both a telephone and pager network, the node must operate on a pager network that is independent of a telephone network. *Id.* at 16–17.

GPNE argues that this construction was in error and is only supported "by a single sentence" in the specification. GPNE JMOL Br. at 13. This argument is contradicted by the record. At the *Markman* stage, GPNE conceded that its node/pager must return a page without a

telephone call:

> What is disclosed in the patents in suit is a device that 'can transmit and receive information'— two-way data packet communication that can obviate the need for telephony voice calls to communicate, which was necessary for one-way pagers of the time. **This is undeniable**.

ECF No. 75 (Reply CC Br.) at 4 (emphasis added; footnote omitted). Moreover, GPNE's Opening Claim Construction Brief also conceded that "where the prior art required use of a telephone system to return a page call, the two-way data communication system of the invention obviates that need and can operate – to that extent – independent from the telephone network." Opening CC Brief at 6. At the *Markman* hearing GPNE's counsel also confirmed that the patent "depicts the design of a two way paging system which operates independently from the telephone systems for wireless." *Markman* Tr. at 93:16–18 (quoting an invention disclosure document in the '267 Patent file history, ECF. No. 69-7 at GPNECorp. 00000314).

As the Court explained in its Order Construing Claims, the Asserted Patents refer to a "two-way paging system." Order Construing Claims at 16–18. The inventors disclosed that this system "operates independently from the telephone system for wireless data communication," and GPNE's expert testimony supported the conclusion that "pager networks and telephone networks are distinct and . . . the electronic componentry and programming that permits a device to communicate on each is generally different." *Id.* Consequently, the Court's construction properly included the two-way data communication feature of the claimed nodes, and permitted GPNE to argue that a combination pager-telephone device infringed the claims, if the accused device met the independent networks limitation.

Accordingly, based on the *Markman* submissions, oral arguments, and the post-trial briefing, the Court rejects GPNE's argument that the Court erred in construing the term "node." The construction of "node" as a "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network" is correct. Order Construing Claims at 9.

b. Waiver Arguments

Apple's opposition brief heavily emphasizes GPNE's waiver of certain claim construction arguments. GPNE JMOL Opp'n at 13-15. Based on the briefing and the record, the Court agrees that (1) GPNE never sought construction of the terms "pager," "paging system," or "telephone network"; (2) GPNE waived two of the claim construction arguments it now asserts; and (3) GPNE never sought reconsideration of the Court's construction of "node," and instead consistently advocated for an overbroad construction.

i. GPNE never sought construction of terms within the construction of "node"

Apple argues that GPNE never requested a construction of the terms "pager," "paging system," or "telephone network," which are in the Court's construction of "node." GPNE JMOL Opp'n. at 14. GPNE takes the position that because its own proposed construction did not include the terms "pager," "paging system," and "telephone network" GPNE was not required to propose any further construction of those terms. *See* GPNE JMOL Reply at 7 ("Apple's argument makes no sense; GPNE at all times sought a construction of the term "node" that did not include "pager" or "paging system" whatsoever.").

GPNE's briefing belies this argument. Each of the five alleged errors regarding "node" deal with the "pager" terms. GPNE JMOL Br. at 9–10. In fact, GPNE's entire *O2 Micro* argument is premised on the argument that the Court should have further construed "pager." *See* GPNE JMOL Br. at 14 ("Having chosen the words "pager" and "paging system" for the construction of the claim term "node," it was still error to leave the scope of those terms undefined when presented to the jury."). However, the Court agrees with Apple that GPNE's arguments suggesting that the Court should have construed "pager," "paging system," and "telephone network" were waived as GPNE never requested construction of those terms. *See Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1320–21 (Fed. Cir. 2003); *see also* GPNE JMOL Reply Br. at 7 (recognizing that GPNE never sought construction of pager, paging system, or telephone network). GPNE failed to raise the issue at the *Markman* stage, in the Joint Pretrial Statement, and

in connection with the jury instructions.

Beginning at the *Markman* stage, the words "pager" and "telephone network" were at issue. Apple's proposed construction of "node" was "a pager in a network operating independently of a telephone network." Resp. CC Br. at 4. At the *Markman* hearing the Court specifically asked the parties to address the issue of whether "pager" would need to be construed. *See Markman* Tr. at 81:19–82:2 ("Are we going to need to have a subsequent claim construction [of the] term [pager]?"). In response, Apple contended that the question of what a pager was to a person of ordinary skill in the art at the time would be a "fact-based issue," and therefore not require additional construction. *Id.* at 85:10–15. When GPNE interjected, GPNE objected only to Apple's arguments regarding the plain and ordinary meaning of the "independent of a telephone [network]" language, but failed to otherwise address or dispute Apple's contention that whether the accused devices were "pagers" was a factual dispute that did not go to the scope of the claims. *See id.* at 88:5–89:25. To the contrary, GPNE told the Court that "if you call it a '[two-way] paging system,'" that would be "perfectly fine." *See Markman* Tr. at 89:12–17.

Next, as Apple points out, GPNE failed to raise the "pager" issue in the parties' statement of "Disputed Legal Issues" within the Joint Pretrial Statement. Apple JMOL at 14 (citing ECF No. 305 (Joint Pretrial Statement) at 9–11). Apple's list of issues included a claim construction dispute over the terms "slot" and "packet." *Id.* at 10. GPNE did not raise any claim construction issues, including any issues related to "node" or "pager." *Id.*

Furthermore, as set forth below, a review of the parties' submissions to the Court on the jury instructions confirms that GPNE did not seek further clarification of the terms "pager," "paging system," or "telephone network," and instead only advocated for its original construction of node halfway through trial. *See* ECF No. 505 (Objections to Final Annotated Jury Instructions) at 2 ("As the Court is aware, at *Markman*, GPNE proposed construing the claim term "node" as "a device in a network that can transmit and receive information." See Dkt. 69 at 3. GPNE maintains that this construction was the proper one."). In the parties' various versions of their "Joint

Proposed Jury Instructions," and in GPNE's objections to the Court's jury instructions, GPNE either accepted the Court's construction of "node" and requested that the Court instruct the jury to apply plain and ordinary meaning to "pager," or requested that the Court adopt GPNE's original proposed construction. *See* Objections to Final Annotated Jury Instructions at 1–5.

Specifically, in the first Joint Proposed Jury Instructions, filed June 19, 2014, GPNE proposed instructing the jury that "node" means "pager with two-way data communication capability that transmits wireless data," while Apple proposed including the Court's entire construction of "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." ECF No. 316 (Joint Proposed Jury Instructions) at 50. GPNE offered no additional or contrary proposals.

In the next set of proposed jury instructions, filed June 25, 2014, the parties agreed to include the Court's entire construction of "node." ECF No. 320 (First Amended Joint Proposed Final Jury Instructions) at 22. Again, GPNE offered no additional or contrary proposals. The parties also agreed that the Court should instruct the jury that "For claim language where I have not provided you with any meaning, you should apply the claim language's plain and ordinary meaning."

The parties submitted Second Amended Joint Proposed Final Jury Instructions on July 15, 2014, where the parties again agreed to the Court's construction of node and the plain and ordinary meaning instruction. ECF No. 335, at 22. As with the previous two sets of proposed jury instructions, GPNE offered no additional or contrary proposals with respect to "node."

It was three months later,[6] on October 13, 2014, during the second week of trial that GPNE first requested that the Court instruct the jury to apply the "plain and ordinary meaning to a person

[6] In the intervening three months, Plaintiff GPNE filed a stipulated administrative motion seeking to withdraw four law firms and the corresponding attorneys of record. ECF No. 355. On July 22, 2014, GPNE's trial counsel, attorneys from the law firm of Susman Godfrey LLP entered notices of appearance for the first time in the instant litigation. *Id.*; *see* ECF Nos. 350, 352–53.

of skill in the art after reading the entire patent and file history" to the terms "pager" and "paging system." ECF No. 461 (Third Joint Amended Proposed Jury Instructions) at 25–26. GPNE also requested additional language purporting to explain the Court's construction of "node." The propriety of this request is discussed further *infra*. Apple objected to this new, additional language. *See id.* at 30–31. On October 18, 2014, the Court issued tentative final jury instructions, which included the Court's full construction of "node" and instructed the jury to apply the "plain and ordinary meaning" to unconstrued claim terms. ECF No. 501 (Final Annotated Jury Instructions [Tentative]) at 24.

GPNE's next submission, on October 19, 2014, "maintain[ed]" that its construction of "node" as "a device in a network that can transmit and receive information" was correct. Objections to Final Annotated Jury Instructions at 2. These submissions, from October 13 and October 19, 2014, were GPNE's first objections in connection with the jury instructions on claim interpretation or on the construction of "node."

After considering GPNE's submissions, the Court instructed the jury that "For claim language where I have not provided you with any meaning, you should apply the claim language's plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention." ECF No. 529 (Final Annotated Jury Instructions) at 24. Although GPNE had belatedly objected to the Court's construction of "node" halfway through trial, the Court overruled GPNE and used the construction of "node" adopted at the *Markman* stage.

In sum, the Court concludes that GPNE failed to request a construction of "pager," "paging system," or "telephone network," over the course of more than two years: from the Court's August 13, 2013 Order Construing Claims until the second week of trial when GPNE first objected to the Court's instructions on claim interpretation or the construction of "node" on October 13, 2014. Accordingly, the Court agrees with Apple that GPNE's arguments requesting construction of "pager," "paging system," or "telephone network" are waived.

ii. GPNE raises two new claim construction arguments in its briefing

GPNE's motion for Judgment as a Matter of Law raises three arguments related to the construction of "node": (1) the Court improperly imported limitations from the specification or preferred embodiments into the claims; (2) the Court's construction ignored the purpose of the invention; and (3) the Court's construction violated principles of claim differentiation related to the '115 Patent, the parent patent of both Asserted Patents. GPNE JMOL at 10–14.

GPNE's first argument, that the Court's construction improperly imported limitations from the specification, is not waived, and was the central argument raised at the Markman stage. However, this argument is not persuasive, as explained *supra*. The latter two claim construction arguments were not raised at the *Markman* stage or in briefing regarding the jury instructions. GPNE provides no citation to prior efforts to raise the latter two arguments, and does not otherwise argue that it properly preserved those arguments for post-trial consideration. The Court therefore concludes GPNE's arguments with respect to the purpose of the invention and claim differentiation are waived. *See Cordis Corp. v. Boston Scientific Corp.*, 561 F.3d 1319, 1331 (Fed. Cir. 2009) ("[L]itigants waive their right to present new claim construction disputes if they are raised for the first time after trial," quoting *Conoco, Inc. v. Energy & Envtl. Int'l, L.C.*, 460 F.3d 1349, 1359 (Fed. Cir. 2006)). A party may not raise new claim construction arguments for the first time in post-trial briefing. *See also Cordis*, 561 F.3d at 1331 (finding that district court correctly declined to consider new claim construction arguments raised in a JMOL brief). Accordingly, the Court does not address these arguments.

iii. GPNE never sought reconsideration of the construction of "node"

Finally, the Court notes that GPNE never sought reconsideration of the construction of "node." Indeed, GPNE has consistently tried to avoid any limiting construction of "node" in an effort to maintain as much breadth as possible in the claims.

At the *Markman* stage, GPNE interpreted the term "node" broadly, in an effort to capture diverse after-arising technology. *See, e.g.*, *Markman* Tr. at 80:14–16 ("It's just some broad term to

describe any electronic device that transmits and receives, over the radio, and is capable of being programmed with this unique protocol."). In addition to smartphones and cell phones, GPNE also wanted to capture Amazon's e-readers within the scope of "node." *See Markman* Tr. at 59:13–21 (Amazon's counsel confirming that GPNE accused Amazon e-readers that use GPRS networks).

Accordingly, GPNE proposed a construction of "a device in a network that can transmit and receive information." Opening CC Br. at 3. As evidence of the breadth of this construction, GPNE acknowledged at trial that it sought licenses from "farms," "dairies," "insurance companies," "soda companies," "butter makers," "chocolate makers," "bakeries," "cell phone makers," and "trucking companies." *See* Tr. at 436:15-438:7. GPNE acknowledged that it sought licenses from these companies "because all of them conform to the GPRS standard." *Id.* at 443:8-9.[7]

Given GPNE's desire to maintain an overbroad construction of "node," its arguments that the Court's construction did not provide "fixed, unambiguous, legally operative meaning to the claim," *Liquid Dynamics Corp. v. Vaughan Co.*, 355 F.3d 1361, 1367 (Fed. Cir. 2004), are especially unpersuasive, as discussed *infra*.

2. The Court Did Not Leave the Scope of the Terms "Pager" and "Paging System" to the Jury

GPNE's second argument is that the Court left the scope of the term "node" to the jury, in violation of *O2 Micro*. GPNE JMOL Br. at 14. GPNE focuses on the terms "pager" and "paging system" within the construction of "node," and argues that the "parties heavily contested the 'ordinary' meaning of 'pager' and 'paging system,'" necessitating a construction of those terms. GPNE Reply Br. at 4. GPNE argues that the construction of "node" was not fixed because "the

[7] Following the Court's Order Construing Claims, some of GPNE's potential licensees refused to take a license, or offered to settle for a very small amount. *See* Tr. at 448:19-449:17 (acknowledging that GPNE believed "ABC Supply Company" infringed based on the company "having a trucking fleet," and offering to settle for $5,000 following this Court's Order Construing Claims); *id.* at 445:22–446:17 (testimony that Darling International refused to take a license based on the construction of "node").

parties disputed fundamental questions including *inter alia* whether a 'pager' operated on a cellular network vs. a simulcast network, used low power vs. high power, and transmitted high data rates vs. low data rates." GPNE JMOL Reply Br. at 3. Having reviewed the Federal Circuit's statements on the specificity required in claim construction, the Court does not find this argument persuasive, and concludes that the construction of node, including the use of the terms "pager," "paging system," and "telephone network" provided a "fixed, unambiguous, legally operative meaning to the claim." *Liquid Dynamics Corp. v. Vaughan Co.*, 355 F.3d 1361, 1367 (Fed. Cir. 2004).[8]

At the outset, as discussed *supra*, the Court notes that GPNE never requested that the Court provide a more detailed construction of "pager" or "node" until well into the trial. *See* Third Joint Amended Proposed Jury Instructions at 25–26. This delay significantly diminishes the persuasive value of GPNE's *O2 Micro* argument. *Function Media, L.L.C. v. Google, Inc.*, 708 F.3d 1310, 1325 (Fed. Cir. 2013) (distinguishing *O2 Micro* and noting that "[i]n *O2 Micro*, the parties disagreed *during claim construction*.") (emphasis added). The Federal Circuit has held that "district courts are not (and should not be) required to construe every limitation present in a patent's asserted claims," *O2 Micro*, 521 F.3d at 1362, especially where the parties do not raise a dispute until after the *Markman* stage. *See Verizon Servs. Corp. v. Cox Fibernet Virginia, Inc.*, 602 F.3d 1325, 1334 (Fed. Cir. 2010) ("Unlike *O2 Micro*, where the scope of a specific claim term was in dispute beginning at the *Markman* hearing and continuing throughout the trial, Verizon never identified at any time during the proceedings before the district court any specific claim term that was misconstrued or that needed further construction."). As in *ePlus, Inc. v. Lawson Software, Inc.*, 700 F.3d 509, 520 (Fed. Cir. 2012), "if [GPNE] desired such a narrow definition, it

[8] Later cases have also held that terms within a court's construction must be sufficiently clear. *See Advanced Fiber Technologies (AFT) Trust v. J & L Fiber Servs., Inc.*, 674 F.3d 1365, 1373–74 (Fed. Cir. 2012) (court should resolve disputes over "a claim term or a disputed term within a claim construction"); *Edwards Lifesciences LLC v. Cook Inc.*, 582 F.3d 1322, 1334 (Fed. Cir. 2009) (district court correctly clarified term within construction).

could (and should) have sought a construction to that effect. In the absence of such a construction, however, the jury was free to rely on the plain and ordinary meaning of the term."

Second, the Court finds *O2 Micro* distinguishable. In *O2 Micro*, the Federal Circuit held that the district court erred in failing to construe the claim limitation "only if," because the parties' claim construction dispute went to the scope of the claim. 521 F.3d at 1352. More specifically, the claims in *O2 Micro* required that a "feedback control loop circuit control the conduction state of the switches 'only if said feedback signal is above a predetermined threshold.'" *Id.* at 1356. The defendants' noninfringement theory was based on the fact that the accused products' feedback control loop circuits would briefly continue to control the conduction state of the switches even after the feedback signal fell below a predetermined threshold. *Id.* at 1356–57. At *Markman*, the defendants argued that the district court should construe "only if" to mean either "exclusively or solely in the event that" or "never except when." *Id.* at 1357. Instead, the district court declined to construe the limitation, and the parties presented expert testimony and argument to the jury "regarding whether or not the 'only if' claim language allowed exceptions." *Id.* at 1365. As the parties had presented a "fundamental dispute regarding the scope of a claim term," the district court erred as a matter of law in failing to resolve it. *Id.* at 1362.

Here, in contrast, the Court did construe the operative claim limitation: "node." Much of GPNE's argument is based on ignoring the entirety of the Court's construction. The Court did not construe "node" as "pager." Instead, the complete construction, which was provided to the jury, is a "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." Order Construing Claims at 18–19; Final Jury Instructions at 24. This is significant because at the *Markman* hearing the parties both recognized that the network issue would be central to determining whether a device was a pager. Apple's counsel represented that "[i]f we're setting up a construction of the term 'pager,' then we would look to what kind of network does that device connect to? What kind of componentry is within that device? What kind of data would it be

capable of sending and receiving?" *Markman* Tr. at 85:2–6. The issue of how to interpret the term "pager" consistently circled back to the issue of whether the accused device "is intended to operate independent of a telephone network." *Id.* at 85:21–22.

Moreover, GPNE did not dispute that the additional network language would clarify what a pager is, and did not contest Apple's argument that this was a fact issue that would turn on whether the accused devices operate independently from a telephone network. *See id.* at 85:10–15, 88:5–89:17. Unlike in *O2 Micro*, where the failure to construe a limitation materially impacted the scope of the claim, here the Court's construction as a whole provided a clear issue of infringement for the jury to decide. Order on Summary Judgment at 8 ("The infringement question presented here, then, is whether a 'pager' can use GPRS and LTE systems."); *see also Lazare Kaplan Int'l v. Photoscribe Techs., Inc.*, 628 F.3d 1359, 1376 (Fed. Cir. 2010) ("[T]he parties' dispute concerns factual questions relating to the test for infringement and not the legal inquiry of the appropriate scope of the [relevant] limitation.").

Third, to the extent GPNE now argues that the definition of "pager" was in dispute, the Court concludes that GPNE's complaints do not relate to the scope of the claims, but to the application of the construed claims to the accused devices. Under these circumstances, *PPG Indus. v. Guardian Indus. Corp.*, 156 F.3d 1351 (Fed. Cir. 1998), is instructive. In *PPG*, the patentee alleged infringement of a glass composition. 156 F.3d at 1352. The relevant claim included the term "consisting essentially of," which the district court construed as "the claimed glass invention has in it the ingredients that are specifically identified . . . Other ingredients may also be present . . . so long as those other unlisted ingredients do not have a **material effect** on the basic and novel characteristics of the glass." *Id.* at 1354 (emphasis added). The patentee argued that whether an ingredient had a "material effect" was a matter of claim construction and should not have been put before the jury. *Id.* In affirming the district court's construction and rejecting the patentee's argument, the Federal Circuit noted that while claim construction must delineate the scope of the claimed invention, it does not mean that a court "may give a claim whatever additional precision

or specificity is necessary to facilitate a comparison between the claim and the accused product." *Id.* at 1355. As in *PPG*, the Court here construed "node" with the "specificity and precision . . . warranted by the language of the claim and the evidence bearing on the proper construction." *Id.* That there is "some inherent imprecision resulting from the use of the term" is a "necessary consequence of treating infringement as a question of fact," not an indication that the Court needed to further construe its construction of "node."

In further support of this argument, GPNE cites to Apple's opening statement, where counsel for Apple accused GPNE of "stretching their claims." Tr. at 216:17. Apple also elicited testimony from its witness suggesting the GPNE was "stretching" the claims. See *id.* at 1760:22-24 (Apple's closing); *id.* at 1303:5-7 (Dr. Rysavy: "My assignment was to determine if . . . GPNE's pager patents were valid if they were stretched to cover cell phones."); *id.* at 1387:19-20 (A. "if you stretch the pager claims to cover phones, then the GSM is prior art."). GPNE argues that by referring to "stretching" the claims, Apple was improperly arguing claim scope. Reviewing these statements in context, however, shows that Apple was arguing to the jury that if the jury found that iPads and iPhones were pagers within the claims (i.e. if the jury found infringement), then the jury should also find that the Asserted Patents were invalid. This argument did not ask the jury to stretch or narrow the claims, but rather to be consistent in applying the maxim "[t]hat which infringes, if later, would anticipate, if earlier." *Peters v. Active Mfg. Co.*, 129 U.S. 530, 537 (1889). The "stretching" statements do not suggest that the scope of the term "pager" was left to the jury.

Indeed, that this is a dispute over whether the accused devices infringe rather than a dispute as to claim scope, as was the case in *PPG*, is evidenced by GPNE's arguments at the summary judgment stage. In opposition to Apple's motion for summary judgment, GPNE focused on the additional clarifying language "independently from the telephone network" in the Court's construction. Much of GPNE's evidence in opposition to Apple's motion for summary judgment of noninfringement involved showing that GPRS and LTE networks include paging functions that

are separate from their cellular functions. *See* Order on Summary Judgment at 9–10 (describing GPNE's evidence). GPNE also presented evidence that a person of ordinary skill in the art would recognize that "modern-day cellular networks include paging technologies that allow devices on the networks to be properly called pagers . . . ." *Id.* at 9. In support of this argument, GPNE cited FCC documents, dictionary definitions, and testimony from Dr. Dinan. *Id.* at 9–10. Thus, there was no dispute at the summary judgment stage that whether the accused devices were pagers could be determined by looking to the network capabilities of the devices. After considering GPNE's evidence, the Court denied Apple's motion for summary judgment, concluding that "GPNE presents sufficient evidence for a reasonable jury to conclude that the accused devices are 'pagers.'" *Id.* at 10.

Finally, as discussed further *infra*, any *O2 Micro* issue would be harmless error. As discussed below, the jury's verdict of noninfringement could have been based on the jury's reasonable determination that GPNE's sole infringement expert was not credible or on GPNE's failure to provide adequate proof on other claim limitations, including "count value," the "aligning/clocking signal" and "differing frequencies." Therefore, judgment as a matter of law or a new trial would not be warranted on an *O2 Micro* issue. *See, e.g.*, *Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1313 (Fed. Cir. 2003) (finding that jury incorrectly imported a limitation into the claims, which required reversal because the imported limitation was the only possible basis for a finding of noninfringement).

3. Apple Did Not Make Arguments that Improperly Narrowed the Claim Scope

GPNE's next argument is that Apple's trial presentation focused on importing limitations into the claims in an attempt to redefine pager and paging systems. GPNE JMOL Br. at 15. GPNE argues that Apple (1) told the jury that "node" was limited to "one-way legacy beepers"; (2) Apple introduced evidence and elicited testimony that contradicted the Court's prior Order on Summary Judgement; and (3) Apple argued prosecution history disclaimer to the jury. GPNE argues that all of this testimony adds up to Apple improperly narrowing the claim scope of "node."

Turning to GPNE's first argument, GPNE's suggestion that Apple limited pagers to "one-way legacy beepers" is not supported by the record. *See, e.g.*, Tr. at 194:6 (Apple referring to the invention as a two-way pager). The only times the jury was told about legacy "beepers" was argument from GPNE's counsel and evidence from GPNE's expert, Dr. Dinan. In GPNE's opening statement, its attorney argued that the patents are not limited to "very old-fashioned beepers that you used to clip on." *Id.* at 183:6–7; *id.* at 183:17–18 (arguing that the claims are "not limited to a simple beeper-type device."); *id.* at 184-1. GPNE's counsel also elicited testimony from Dr. Dinan that the patents were not directed to "the same little Motorola beeper that I used to carry on my belt." Tr. at 516:2; *id.* at 715:14–15 ("The Patent figures do not describe that little beeper that you put on your belt."). GPNE does not cite to any testimony from Apple suggesting that the patents were limited to old-fashioned beepers. The testimony that GPNE does cite contrasts cellphones, cellular networks, pagers, and paging networks, which is proper for a jury to consider in evaluating whether the claims read onto the accused devices. For example, Apple's counsel argued that "Apple's phones are not pagers and they don't work with a paging system," *id.* at 211:10–11, and that "they [i.e., paging systems and telephone networks] operate in a completely different way," *id.* at 215:19–20. Testimony highlighting the difference between the claims as construed and the accused devices is proper.

As to GPNE's second argument, GPNE argues that Apple's arguments and evidence contradicted the Court's prior orders on Summary Judgment and Claim Construction. GPNE JMOL Br. at 8-9. GPNE argues that in denying summary judgment of noninfringement, "the Court repeatedly *rejected* Apple's argument that the term 'node' even when limited to a 'pager' capable of operating on a 'paging system' must exclude iPhones and iPads simply because they were not legacy beepers that operated on broadcast paging systems." *Id.* at 8 (emphasis in original). The Court's Order on Summary Judgment did not reject such an argument. GPNE's evidence at summary judgment showed that a person of ordinary skill might consider a smartphone with multiple features to be a pager. Order on Summary Judgment at 10. Therefore, the Order on

Summary Judgment properly found that whether the accused products "can be considered 'pagers' in addition to smartphones and tablets" was a question of fact for the jury. *Id.*

GPNE's JMOL arguments misconstrue the effect of the Court's denial of Apple's motion for summary judgment, and are exactly why courts typically exclude reference to prior orders under Federal Rule of Evidence 403 as presenting a substantial risk of jury confusion and unfair prejudice. *See* ECF No. 319 (Pretrial Order re: Motion in Limine) at 1–2; *S.E.C. v. Retail Pro, Inc.*, No. 08CV1620-WQH-RBB, 2011 WL 589828, at *4 (S.D. Cal. Feb. 10, 2011) (granting motion in limine to exclude reference to summary judgment order). The Court's Order on Summary Judgment did nothing more than find issues of fact for the jury. It did not resolve any fact-finding or issues of infringement in favor of GPNE. *See* Order on Summary Judgment at 10 ("Therefore, a genuine issue of material fact as to whether the accused devices are "pagers" remains for resolution at trial.").

GPNE further faults Apple for arguing that the iPhone, which is obviously a phone, is not also a pager. Apple's argument that the iPhone is not a combination pager-cellphone was entirely proper, as the Court's prior rulings left that factual question of infringement for the jury. Apple's support for its argument, including references to the prosecution history of the Asserted Patents, helped the jury to apply the plain and ordinary meaning of "node" to the accused devices, and thus was proper. *See, e.g., Wahpeton Canvas Co., Inc. v. Frontier, Inc.*, 870 F.2d 1546, 1552 (Fed. Cir. 1989) (affirming jury verdict of noninfringement as "[t]he jury had before it the prosecution history and testimony directed to" the absence of claim limitations in accused products).

As to the "operates independently from a telephone network" aspect of the Court's construction, the issue of fact for the jury was whether the GPRS and LTE networks could operate independently of the GSM network. *See also* Order on Summary Judgment at 8 ("The infringement question presented here, then, is whether a 'pager' can use GPRS and LTE systems."). Apple never suggested that the accused devices were not nodes because the devices send voice or other data, such as text messages, over the GSM telephone network. Rather Apple

presented evidence demonstrating that the GPRS and LTE data networks were not independent from the telephone networks.[9] *See, e.g.*, Tr. at 1145:2–18 ("Q: Do Apple products work on paging systems that operate independently from a telephone network? A: Not at all."). Moreover, Apple was entitled to argue that regardless of whether the accused devices are phones, the devices did not have the properties that allow a pager to function on a paging system that operates independently from a telephone network. *See id.* Accordingly, GPNE's suggestion that Apple's arguments narrowed the claim scope in violation of the Court's prior Orders mischaracterizes Apple's arguments at trial.

Third, GPNE argues that Apple improperly imported limitations into the claims and argued prosecution history disclaimer to the jury. GPNE JMOL Br. at 13. GPNE contends that Apple should not have been permitted to argue to the jury that the inventors distinguished between cell phones and pagers at the Patent Office. *Id.* GPNE points to testimony from Apple distinguishing cell phones and pagers, including arguments that "the inventors at GPNE told the patent office" that cell phones and pagers were different. Tr. at 215:23–216:3.

The Court does not agree that the record citations to which GPNE points show that Apple argued prosecution history disclaimer to the jury. As discussed *infra*, the Court never held that cell phones and pagers necessarily overlap, only that they *could* overlap. Order on Summary Judgment at 10. The inventors obviously recognized this in distinguishing the two and in separating their pager device and paging system from the telephone network. *See, e.g.*, Tr. at 299:3–12 (Gabriel Wong testifying on how GPNE believed its invention was an improvement over prior art cell phones and pagers). Thus, Apple was entitled to argue that cell phones and pagers have different capabilities and characteristics based on the differences between paging systems and telephone networks, and that pagers and cellphones would be considered different to one of ordinary skill in the art at the time of the invention.

[9] As discussed *infra*, the jury could have reasonably concluded that Dr. Dinan's testimony about the independence of GPRS and LTE from GSM was not credible.

The trial transcript reflects that Apple used the patentee's statements to the Patent Office to illustrate to the jury the differences between a cell phone and a pager at the time of the invention. Dr. Wilson explained how Gabriel Wong's description of the invention corresponded to the functionality of pagers and paging systems. For example, Dr. Wilson explained how Gabriel Wong's description of the invention as having "lower power consumption," "points to a paging system rather than a cellular phone . . . because cellular phones are always sending out information. . . . Pagers don't do that, so the battery can last weeks." Tr. at 1136:7–16. This was proper testimony to aid the jury in applying the claims to the accused devices. *See Wahpeton Canvas*, 870 F.2d at 1552. Indeed, the limitations that GPNE accuses Apple of importing into the claims, including that a pager has low data rates, high radiated power, long battery life, is lightweight, and uses simulcasting, come from the prosecution history of the Asserted Patents. *See also* ADX-320 (Dr. Wilson demonstrative listing differences between "paging system" and "cellular phone networks"). Specifically, Gabriel Wong's Rule 131 Declaration to Patent Office lists the following characteristics of his paging system:

> 1. Light Weight
>
> Majority of the weight in a portable system is battery, by reducing power requirement, we can achieve a lighter communication device.
>
> 2. Compact
>
> The size of a pager can be made smaller than cellular phone due to its simplify [sic] design in both the electronics and the size of the power supply needed.
>
> 3. Battery
>
> Lower power consumption.

GPNECorp. 00000323. The Asserted Patents themselves also disclose the following paging system characteristics identified by Dr. Wilson:

- *Using FCC-allocated frequencies to communicate on a pager system*. *See* '492 Patent at 14:14–18. This is also found in Dr. Wong's PTO submission. ECF No. 69-7 at GPNECorp. 00000314.

- *Transmitting at a high power range*. The Asserted Patents disclose transmitting at 3 watts to 1000 watts. '492 Patent at 14:16. Dr. Wilson testified that the high power transmission also goes to whether a pager can receive a message in an elevator or basement. Tr. at 1150:12–25.

- *Simulcasting a signal*. Although the parties disputed the import of Figure 9 of the Asserted Patents, Dr. Wilson testified that simulcasting was a pager characteristic and Figure 9 showed a simulcasting system. Tr. at 1148:21–1149:12; 1158:1–17.

In conclusion, Apple's evidence aided the jury in applying the plain and ordinary meaning of the term "pager" to the accused devices. Although GPNE wished for a broader construction of node, the Court rejected the "device on a network" construction and limited node to "a pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." This construction resolved the dispute over the scope of "node" and allowed the parties to argue whether the accused devices fell within the claims. Apple won that debate, as shown by the jury's verdict, and none of Apple's arguments or evidence requires granting a new trial.

4. Apple Did Not Apply an Improper "Person on the Street" Standard to Claim Terms

GPNE's next argument is that Apple argued to the jury that the terms "pager," "paging system," and "telephone network" should be interpreted as understood by a layperson. GPNE JMOL Br. at 21. Apple argues that this argument was waived when GPNE failed to object to the testimony GPNE cites as the basis for GPNE's argument. Apple further argues that GPNE actually introduced the "person on the street standard."

As a threshold matter, Apple is correct that it was GPNE's expert Dr. Dinan who, on direct examination, first introduced a "person on the street" standard. Tr. at 515:25–516:2 (Dr. Dinan: "Well, of course if you go on the street and ask someone, "what is a pager?" they're going to point you to the same little Motorola beeper that I used to carry on my belt."). Dr. Dinan then presented further testimony on whether the accused devices were "pagers" that met the Court's construction of "node." Tr. at 554:1–17 (explaining that "In 1994, a person would consider a pager as a two-

way data communication device"); *id.* at 563:1–9 (explaining that iPhones and iPads transmit and receive data). This testimony illustrated for the jury the difference, according to GPNE, between a "layperson" and a "person of ordinary skill" interpretation of the claims. On cross-examination, Apple's counsel elicited further testimony from Dr. Dinan on the difference between a pager according to a person on the street and a node under the Court's construction. Tr. at 664:9–17 (comparing DTX 361 (Motorola pager) to Court's construction); *Id.* at 665:10–12 (comparing iPad to Court's construction). GPNE did not object to this line of questioning, nor to Apple's questioning on what "people" in 1993–1994 would have considered to be a pager. *Id.* 665:13–666:11.

Moreover, the Court agrees with Apple that GPNE did not object to the testimony cited in support of GPNE's argument that Apple invited the jury to apply an improper standard to interpretation of claim terms. GPNE cites testimony from Dr. Dinan on cross-examination, where Apple questioned Dr. Dinan on whether "in 1993 or 1994 . . . people would not have considered the iPad to be a pager?" *See* GPNE JMOL Br. at 21–22, citing Tr. at 665:10-667:23. GPNE made no objections to this testimony or line of questioning. *See* Tr. at 665:10–667:23 (showing GPNE made no objections). GPNE then cites to testimony that Apple elicited from non-technical witness, including GPNE's damages expert, Mr. Dansky, and Apple's Senior Director of Product Marketing, Mr. Casanova, on whether the accused devices were "pagers." GPNE JMOL Br. at 22, citing Tr. at 945–947 (Apple questioning Mr. Dansky on whether he considered the accused devices to be "pagers"); *Id.* at 1079–80 (Apple questioning Mr. Casanova on whether the iPhone 4 and iPhone 5 were pagers). Although GPNE now argues that this testimony encouraged the jury to interpret claim terms from the perspective of a "person on the street" instead of a person of ordinary skill, the record shows that GPNE did not object to this testimony.

In addition to its "person on the street" argument, GPNE also contends that Dr. Wilson failed to apply the "ordinary meaning to one skilled in the art in light of the patent and file history from the time period of the invention." Mot. at 21. At trial, Dr. Wilson testified that she reviewed

FCC and ETSI standard setting documents from beyond the 1993–1994 timeframe and referenced those documents. Tr. at 1160–61, 1169. GPNE objected to the FCC and ETSI documents on relevancy grounds, arguing that the standard setting documents post-date the patents, and thus are not relevant to the infringement analysis. In its motion, GPNE now argues that Dr. Wilson's reference to the FCC and ETSI documents is proof that Dr. Wilson applied an improper standard to support her opinion that paging systems exclude cellular data networks. However, Dr. Wilson confirmed on cross-examination that she used the proper "person of ordinary skill at the time of the invention" standard in interpreting the claims. Tr. at 1266:2–6. Moreover, the Court overruled GPNE's objections to the FCC and ETSI documents because the documents were relevant to the question of infringement, as evidenced by GPNE's own reliance on similar FCC documents in GPNE's summary judgment briefing. *See* Order on Summary Judgment at 10 (discussing GPNE's evidence from the FCC).

In sum, none of the testimony cited by GPNE in GPNE's JMOL briefing introduced error regarding the proper interpretation of the claims. Instead, the testimony shed light on the factual question of whether the accused devices met the claim limitation "node." The bulk of Dr. Dinan's testimony involved comparing the asserted claims to the GPRS and LTE standards, which is an issue of fact for the jury. Dr. Wilson's testimony involved comparing the claims to the accused devices. In support of her testimony, Dr. Wilson relied on documents from standard setting bodies, on which GPNE also relied, and on FCC documents to aid her in comparing the accused devices to the claims as construed. This was proper testimony for the jury to consider in doing its infringement analysis.

Finally, any error in Apple's trial presentation was cured by the jury instructions, which as discussed *infra*, instructed the jury to apply a person of ordinary skill in the art at the time of the invention standard. Final Jury Instructions at 23. The Court must assume that the jury followed the instructions, and so any error as to the testimony elicited about a layperson's understanding of the claim terms was harmless. *Deck v. Jenkins*, 768 F.3d 1015, 1034 (9th Cir. 2014) ("[A] jury is

presumed to follow a judge's instructions. This is true even when a party provides contrary instructions.") (citation and quotation omitted).

5. The Court Properly Instructed the Jury

GPNE's final argument as to node is that the Court failed to properly instruct the jury when the Court did not include GPNE's requested jury instructions. GPNE JMOL Br. at 23–24.[10] GPNE raises three points: (1) the Court erred in declining to include a supplemental instruction on "node"; (2) the Court should have instructed the jury to consider the entire file history of the Asserted Patents prior to deciding infringement; and (3) the Court's instruction did not tell the jury to apply plain and ordinary meaning to terms within a construction, i.e., "pager."

Turning to GPNE's first argument, GPNE requested the following instruction:

> The Court's construction does not prohibit a "node" from being both a pager and a telephone. A pager could transmit certain communications on a paging system that operates independently from a telephone network while engaging in other types of communication on the telephone network.

Third Amended Joint Proposed Jury Instructions at 25; Dkt. No. 505 at 1. As discussed *supra*, the Court's construction of "node" adopted at *Markman* was correct. GPNE's further instructions on "node" would have expanded the Court's construction without providing any additional clarity to the jury.

More specifically, GPNE's first sentence, to instruct the jury that a "node" can be both a pager and a telephone, was unnecessary as Apple did not suggest that if the accused devices included both telephone and pager components the devices could not infringe. Instead, Apple argued that the accused devices would not be considered "pagers" by one of ordinary skill in the art, and that the accused devices did not operate independently of a telephone system. *See* GPNE JMOL Opp. at 23.

GPNE's second sentence, to instruct the jury that "[a] pager could transmit certain

[10] The Court notes that GPNE did not mention this issue in its reply brief. *See* ECF No. 580 (GPNE JMOL Reply Br.).

communications on a paging system that operates independently from a telephone network while engaging in other types of communication on the telephone network" was duplicative of the Court's construction, which already specified that a pager operates independent from a telephone network. Furthermore, the jury heard extensive testimony on how the GPRS and LTE networks interact with other networks. *See, e.g.*, Tr. at 692–69, 1277–84. It was not necessary to further instruct the jury as to what "operates independently" means. As discussed *infra*, Apple presented substantial evidence that the GPRS and LTE networks do not operate independently from a telephone network, which was evidence on which the jury was entitled to rely in finding noninfringement.

Accordingly, neither of GPNE's requested instructions was necessary to correct an improper argument about the scope of the term "node," and any error in failing to give the requested instructions was harmless. "A jury verdict will be set aside, based on erroneous jury instructions, if the party seeking to set aside the verdict can establish that those instructions were legally erroneous, and that the errors had prejudicial effect." *Bettcher Indus., Inc. v. Bunzl USA, Inc.*, 661 F.3d 629, 641 (Fed. Cir. 2011) (quoting *NTP, Inc. v. Research In Motion, Ltd.*, 418 F.3d 1282, 1311 (Fed. Cir. 2005), *abrogated on other grounds by Zoltek Corp. v. United States*, 672 F.3d 1309 (Fed. Cir. 2012) (en banc)). Here, as GPNE has not shown a prejudicial effect from the instructions, the Court will not set aside the jury's verdict.

As to GPNE's second argument, GPNE argues that the Court erred in declining to include an instruction to apply plain and ordinary meaning "after reading the entire patent and file history." ECF No. 461 at 25. The Court gave the jury the construction of "node," among other terms, and further instructed the jury that "For claim language where I have not provided you with any meaning, the claim language's plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention applies." ECF No. 549 (Final Jury Instructions) at 23.

GPNE's contention that the Court should have instructed the jury to read the "entire patent and file history" is without merit. GPNE's proposed instruction was improper, as GPNE's

instruction would have essentially implied that the jury must read the entire patent and file history (hundreds of pages) before reaching a verdict. The instruction to apply ordinary meaning to a person of skill in the art at the time of the invention was consistent with the testimony the jury heard, with the arguments GPNE and Apple made, and with black letter claim construction law. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc) (words of a claim are generally given their ordinary and customary meaning, which is the meaning a term would have to a person of ordinary skill in the art at the time of the invention).

Second, as Apple notes in its opposition, the more limited instruction that the Court gave was favorable to GPNE. Instructing the jury to consider the entire file history would have further highlighted Apple's evidence as to what a person of ordinary skill in the art at the time the invention was made would consider to be a "pager." As explained *supra*, Apple primarily relied on Gabriel Wong's Rule 131 Declaration to Patent Office distinguishing pagers and cell phones. That declaration is part of the file history. In contrast, the Court's instruction to apply the "plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention" highlighted GPNE's central theme at trial, which was that one of ordinary skill in 1993–1994 would not limit a pager to "legacy" pagers.[11] GPNE cannot show any prejudicial error in the jury instructions, and judgment as a matter of law or a new trial cannot be granted on that basis. *Bettcher Indus., Inc.*, 661 F.3d at 638.

Turning to GPNE's final argument, that the instruction did not inform the jury to apply plain and ordinary meaning to terms within the Court's instruction, GPNE JMOL Br. at 23–24, the Court finds GPNE's argument is not supported by the trial record. The Court instructed the jury:

[11] Apple's argument that the Court's instruction to apply a person of ordinary skill *at the time of the invention* standard was improper is without merit. Apple would have left out any reference to the "time of the invention" or "person of ordinary skill," and instead proposed instructing the jury to apply the "plain and ordinary" meaning of the terms not construed by the Court. *See* ECF No. 537 (Apple's Objections to Final Jury Instructions) at 1–2. Apple even agreed at *Markman* that the parties would present evidence as to what a person of ordinary skill would consider a "pager." *Markman* Tr. at 85:13–15 ("We could talk about what a pager is or isn't in the perspective of one of ordinary skill in the art at the time that these patents were filed.").

"For claim language where I have not provided you with any meaning, the claim language's plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention applies." Final Jury Instructions at 23. GPNE's counsel reiterated this standard in closing, highlighting the Court's instruction: "If you look at the Court's instructions that she's given you, if you look at instruction number 20, she says right here, "For claim language where I have not provided you with any meaning, the claim language's plain and ordinary meaning to a person of ordinary skill in the art at the time of the invention applies." *Id.* at 1693:18–23; 1749:12–19 (same in rebuttal closing).

Furthermore, as Apple points out in its opposition, GPNE repeatedly argued to the jury that they should apply "the perspective of someone skilled in the art" to the terms "pager" and "paging system." GPNE JMOL Opp'n Br. at 24. For example, Dr. Dinan told the jury that "for patents, we don't look at the modern definition of the term . . . we have to ask ourselves what a person skilled in the art would consider what a pager or paging system is after that person reads the entire patent at the time of the invention." Tr. at 1533:11–16. GPNE's counsel also argued to the jury that the instruction supported Dr. Dinan's testimony:

> What the Court has not construed is what does it mean to use the word "pager"? Or "paging system"? Or "telephone network"?
>
> And that determination is what Dr. Dinan has been explaining for eight hours on the stand. To determine that is not from the viewpoint of a person on the street. It's from the viewpoint of someone highly skilled in wireless data communications who studies the patents and determines what was meant when Gabriel Wong used the term "pager" in those patents."

Id. at 1695:11–23. Thus, read as whole in the context of the entire trial, the Final Jury Instructions informed the jury to apply the plain and ordinary meaning of the words "pager" and "paging system." *Bettcher*, 661 F.3d at 638.

Accordingly, the Court denies judgment as a matter of law and a new trial based on GPNE's challenges to the jury instructions. Having addressed each of GPNE's five errors involving the term "node," the Court turns to GPNE's remaining arguments.

B. Even if the Court Erred Regarding "Node," Neither Judgment as a Matter of Law Nor a New Trial is Warranted

For the reasons explained above, the Court did not err with regard to the construction of node as "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." Order Construing Claims at 9. Regardless, even if the use of the term "pager" was error, a reasonable jury could have found noninfringement for several other reasons.

At trial, GPNE had the burden of proving that the accused devices meet each element of Claim 44 of the '492 Patent and Claims 19 and 22 of the '954 Patent. Apple argues that the jury could have found noninfringement based on the lack of credible expert testimony on infringement. Moreover, in addition to Apple's arguments with respect to "pager" and "paging systems," Apple also presented evidence at trial that the accused devices did not infringe based on the following limitations: the "operates independently from a telephone network" language within the construction of "node"; "count value"; "aligning/clocking signal"; and "differing frequencies." The Court addresses these arguments in turn.

1. Expert Credibility

Apple opposes GPNE's motion for judgment as a matter of law, or in the alternative, a new trial, by contending that the jury could have reasonably concluded that GPNE did not meet its burden of proof as to infringement as a general matter. As Apple explains, Dr. Dinan was GPNE's sole expert as to infringement, and the jury could have reasonably discredited his testimony for at least three reasons: (1) Dr. Dinan's statement that a Motorola pager was "absolutely not" a pager; (2) Dr. Dinan's refusal to sign the protective order and subsequent lack of access to relevant confidential information; and (3) Dr. Dinan's cursory dismissal of contrary evidence. Moreover, the jury could have credited the testimony of Apple's expert, Dr. Wilson, who was a "person of ordinary skill in the art" at the time of the invention, and not credited the testimony of Dr. Dinan, who conceded that he was not a "person of ordinary skill in the art" at the time of the invention.

First, during cross-examination, Apple presented Dr. Dinan with a Motorola pager, which

Apple represented had two-way data communications capability and operated on a paging system independent of a telephone network. When asked whether the Motorola pager "was a pager" as described by the claims, Dr. Dinan responded "absolutely not." Tr. at 664:9–665:12. According to Apple, Dr. Dinan's statement was not only conclusory, but implausible in light of the parameters of Apple's question, and inconsistent with Dr. Dinan's prior testimony. More specifically, Dr. Dinan had agreed that the Motorola pager "transmits wireless data communications on a paging system that operates independently from a telephone network," but still insisted, without explanation, that the Motorola pager did not meet the claim construction. Tr. at 664:25–665:9. On the other hand, when presented with an Apple iPad, Dr. Dinan declared that the iPad was "exactly" a pager. Tr. at 665:12.

Second, Apple cross-examined Dr. Dinan as to the basis of his infringement opinion. Dr. Dinan was barred from examining confidential documents that actually established the accused devices' compatibility with the GPRS, EDGE, and LTE standards because Dr. Dinan refused to sign the protective order in the case. GPNE relied, instead, on the testimony of Dr. Birkett to establish that the accused devices complied with the GPRS, EDGE, and LTE standards, based only on third party testing and not on Dr. Birkett's own testing. Dr. Birkett did not, however, offer any opinion as to infringement. At bottom, Apple's strategy at trial relied on emphasizing that Dr. Dinan had not actually examined any of the evidence that could support his ultimate conclusion that the accused devices infringed GPNE's patents, or that Dr. Dinan had even communicated with the sole GPNE expert who had examined the third party standards compliance testing:

> Q: And you said over and over again, oh, the certification test, that helped you with your infringement opinions; right?
>
> A: Yes.
>
> Q: And you're referring to Cetecom documents; is that right?
>
> A: No. I don't know the name Cetecom.
>
> Q: Right. Because you've never reviewed a single one of those Cetecom certification documents; correct?

> A: Well, I didn't need to. Dr. Birkett, another GPNE's expert, reviewed those and I understand that Apple passed those certification tests . . . .
>
> Q: Sir, can you answer my question, you didn't look at the certification documents; right?
>
> A: No, I did not.
>
> Q: Okay. So you said Dr. Birkett did, but Dr. Birkett is another expert that GPNE hired in this case; right?
>
> A: Yes.
>
> Q: However, for whatever reason, you've never spoken with Dr. Birkett about his opinions in this case; correct?
>
> A. No, I have not spoken.
>
> Q: So even though you say you're relying on him for this certification business, you've never even had a conversation with him about it; correct?
>
> A: That's irrelevant because I wasn't allowed to --
>
> Q: Can you answer my question, sir?
>
> A: I said no.
>
> Q: You've never talked to him?
>
> A: I answered already. I said, no, that's irrelevant. I didn't need to talk to him.

Tr. at 673:8–674:11. Moreover, the single GPNE expert that did evaluate confidential information, Dr. Birkett, conceded that he did not speak with any Apple or third-party engineers, review any source code, conduct any independent testing, or examine any documents other than the confidential Cetecom test reports. *See* Tr. at 821:23–825:25. As Dr. Dinan's infringement analysis depended on Dr. Birkett's review of the Cetecom test results, the jury could have also discredited Dr. Dinan's opinions based on Dr. Birkett's testimony that:

> Q. Okay. Sir, I asked you before GPNE hired you to be a testifying expert in this case, did you have any experience analyzing Cetecom test reports?
>
> A. Not that I recall, no.

Q. No. The answer is no?

A. That's right.

Tr. at 826:24–827:4.

Third, Apple argues that the jury could have reasonably discredited Dr. Dinan's testimony based on his dismissal of any evidence contrary to his position as "irrelevant." When questioned as to whether Dr. Dinan had examined any documents from Apple or from the manufacturers of the baseband processors,[12] or met with any Apple engineers, Dr. Dinan responded repeatedly with the statement "That's irrelevant":

Q: You didn't talk to any Apple engineers; Correct?

A: No. That's irrelevant.

Q: You didn't look at a single Apple diagram; Correct?

A: That's irrelevant. No.

Q: You didn't look at a single Apple schematic?

A: No. That's irrelevant.

Q: You didn't look at any signal flow charts from Apple's technology; Correct?

A: No.

Q: You didn't look at any source code from Apple; Correct?

A: No. That's -- these are irrelevant.

See, e.g., Tr. at 670:7–672:1.

In contrast, Apple's noninfringement expert, Dr. Wilson, testified that she examined the confidential Cetecom test reports, the deposition transcripts from Apple engineers, and technical documents from Apple and third party manufacturers. *See* Tr. at 1125:17–1126:1. Dr. Wilson relied on all of this evidence to reach her conclusion of noninfringement.

Finally, during cross-examination, Dr. Dinan conceded that he was not a person of

[12] The baseband processors found within the accused devices are the smallest saleable patent practicing unit. *See* ECF No. 242, *Daubert* Order at 24–25.

ordinary skill in the art at the time of the invention, but that Apple's noninfringement expert, Dr. Wilson, was a person of ordinary skill in the art at the time of the invention.

> Q. All right. One last topic, Dr. Dinan. You've repeatedly said over and over again that we need to focus on one of ordinary skill in the art, and I think we're now focused on 1994. Is that right?
>
> A. Yes.
>
> Q. And you agree with me, sir, that you were not -- you were not a person of ordinary skill in 1994; correct?
>
> A. That's right.
>
> Q. However, Dr. Sarah Kate Wilson was a person of ordinary skill in 1994; correct?
>
> A. I don't know.
>
> Q. Well, she got her bachelor's degree in 1979. Do you remember that?
>
> A. Okay.
>
> Q. And she got her master's degree in 1987. Do you remember that?
>
> A. Okay.
>
> Q. And she got her Ph.D. from Stanford in 1994. Do you remember that?
>
> A. I don't remember that, but I take your word on that.
>
> Q. Well, assuming I'm correct, she was a person of ordinary skill in the art by 1994; correct?
>
> A. That assumption, I'm not disputing that.

Tr. at 1640:18–1641:15. In combination with Apple's other attempts to discredit Dr. Dinan's testimony, the jury could have found Dr. Wilson to be a more credible expert because she was a person of ordinary skill at the time of the invention, and Dr. Dinan explicitly conceded that he was not.

The Court therefore agrees with Apple that, taken as a whole, the jury could have discredited Dr. Dinan's testimony as to infringement. Where there is contradictory expert

testimony, it is not unreasonable for the jury to discredit the testimony of a party's expert. *See, e.g., Retractable Techs., Inc.*, 653 F.3d at 1309. Here, the jury heard Dr. Dinan admit that he had not personally examined the accused devices' code, technical documents, or the evidence establishing that the accused devices were (1) compatible with the GPRS, EDGE, and LTE standards, and (2) capable of performing the functions required to show infringement. In conjunction with the noninfringement testimony provided by Dr. Wilson, Dr. Dinan's concession that he was not a person of ordinary skill at the time of the invention, and Apple's other attempts to discredit Dr. Dinan's testimony, the jury could have reasonably disbelieved Dr. Dinan. Moreover, GPNE's arguments in support of its motion for judgment as a matter of law "essentially ask [the Court] to credit its position on [infringement] over" Apple's position." *Ericsson, Inc. v. D-Link Sys., Inc.*, 773 F.3d 1201, 1224 (Fed. Cir. 2014). Here, the parties presented conflicting expert testimony on the question of infringement, and the jury had reasonable grounds to disbelieve GPNE's sole infringement expert. *See id.* at 1224–25; *see also i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 848 (Fed. Cir. 2010) (holding that following conflicting expert testimony, "jury was free to disbelieve" one expert); *Kinetic Concepts, Inc. v. Blue Sky Med. Grp., Inc.*, 554 F.3d 1010, 1024 (Fed. Cir. 2009) (finding that a jury can accept the testimony it finds most persuasive). As GPNE had the burden to prove infringement, there is "no reason to disturb the jury's verdict." *Ericsson*, 773 F.3d at 1225.

2. "Operates Independently From a Telephone Network"

In addition to Apple's arguments with respect to expert credibility, Apple further contends that the jury could have found noninfringement based on four claim limitations: (1) the "operates independently from a telephone network" language within the construction of "node"; "count value"; "aligning/clocking signal"; and "differing frequencies." The Court begins by addressing the "operates independently from a telephone network" language within the construction of "node."

Each asserted claim includes the "node" limitation, which as discussed *supra* was

construed as requiring that the node "transmits wireless data communications on a paging system that operates independently from a telephone network." Order Construing Claims at 9. Apple presented substantial evidence that the accused devices did not operate independently from a telephone network because the GPRS and LTE networks share resources with, and are dependent on, the GSM network.

GPNE's theory of the case was that the GPRS, EDGE, and LTE networks could be considered "paging networks" that share resources with, but are independent from, the GSM telephone network. The Court allowed GPNE to proceed to trial on this theory, finding disputed issues of fact as to whether the networks were independent and thus denying summary judgment. Order on Summary Judgment at 11–16.

At trial, both parties presented testimony about independent networks. Apple cites to testimony from both Dr. Dinan and Dr. Wilson in support of the jury's finding of noninfringement. Specifically, Dr. Dinan agreed that the GPRS network would "fall down" if the GSM resources were removed. Tr. at 692:12–21. Furthermore, Dr. Dinan's own tests showed that GSM signals, i.e. telephone signals, were used for sending the "immediate assignment message," which Dr. Dinan mapped onto the "first grant signal" limitation of the claims. Tr. at 637:11–21. Apple's counsel pressed Dr. Dinan on this issue and elicited further testimony:

> Q: And you used this slide [Dr. Dinan's slide 143] to try to suggest to the jury that the Apple iPhone 4S had a first grant signal; right?
>
> A: Yes, immediate assignment message.
>
> Q: And that first grant signal, or immediate assignment message, is part of a, in your view, a paging system that operates independently from a telephone network; right?
>
> A: That's exactly right.
>
> Q: We agreed a few minutes ago that GSM is a telephone technology; right?
>
> A: That is correct.

> Q: And, yet, the very signal that you rely on is a GSM L3 signal; right?
>
> A: Yes. This is GSM layer 3 signal. This is message shared by both GSM and GPRS. No matter what you call it, it's a message that is shared by both technologies. As you see, I'm testing GPRS technology, but GSM layer 3 shows up here.

Tr. at 702:7–22. Thus, based on Dr. Dinan's own test results the jury could have reasonably concluded that GSM and GPRS do not operate independently.

Dr. Wilson further testified that LTE would not work without GSM resources:

> Q: What happens if we were to remove the cellular telephone network components that are shown here in this diagram from DTX 142?
>
> A: Your phone would not work.
>
> Q: What about the data capabilities of my phone, the GPRS, EDGE, and LTE capabilities?
>
> A: That would not work.

Id. at 1180:17–23. The jury could have reasonably relied on Dr. Wilson's and Dr. Dinan's testimony to find noninfringement.

GPNE argues that no reasonable juror could have found that the GPRS and LTE networks are dependent on GSM because (1) Apple improperly defined GPRS and LTE as telephone networks and (2) Dr. Wilson admitted that GPRS and LTE were capable of operating independently. GPNE JMOL Reply Br. at 13–14. The Court does not find either of these arguments persuasive.

First, Apple did not "define" GPRS and LTE as telephone networks. GPNE points to Apple's statements that the accused devices access the GPRS and LTE systems through cellular phone carriers like AT&T, Verizon, and T-Mobile. Tr. at 211:11–14; *id.* at 1145:12–18. These statements did not "define" the GPRS and LTE systems as cellular systems, it was simply testimony from Apple that the only way the accused devices could operate on the GPRS and LTE systems was through a telephone network, i.e., the devices did not operate independently from a telephone network. Furthermore, GPNE did not make any objection to this testimony.

Second, Dr. Wilson did not concede that GPRS and LTE could operate independently of a telephone network. GPNE cites the following testimony from Dr. Wilson:

> Q: Right? And so what that's telling you is you could build just a GPRS network, a data network, by itself without implementing the circuit switched telephone network; correct?
>
> A: Well, if you implemented a GPRS network, you would need GSM technology to do that and you would need GSM protocols. So you would need GSM infrastructure to do it because it's based on GSM.
>
> Q: But you wouldn't need a circuit switched telephone network to go along with it, would you?
>
> A: You wouldn't need to connect to the PSTN [public switched telephone network] necessarily if you're just doing data transfer.

Tr. at 1280:12–22. This testimony does not concede that GPRS is independent from GSM, only that GPRS may be used without connecting to the public switched telephone network, the "PSTN." The PSTN is only one example of a telephone network, a "circuit switched" "telephone network." Tr. at 1279:17–18. "Circuit switched" networks involve a "dedicated . . . line" between two users, where the "time slot and frequency [are] allocated to the entire period of the call." Tr. at 527:9–19 (Dr. Dinan direct). GPNE contrasted "circuit switched" networks like the PSTN with GPRS, EDGE, and LTE, which use "packet switching" technology where "time slots and frequencies or any type of network resources are reserved only for transmission of packets and then . . . released." Tr. at 528:21–529:15. The testimony GPNE elicited from Dr. Wilson is limited to showing that it is possible to send data over the GPRS network without connecting to one specific type of telephone network: the PSTN. The testimony does not establish that GPRS is independent of all telephone networks, such as GSM. Dr. Wilson previously testified extensively that the "GPRS, EDGE and LTE protocol[s are] dependent upon cellular telephone network components." *Id.* at 1185:8–11. Additionally, as discussed below, Dr. Wilson testified that the Patent Office found that GPNE's packet-switched versus circuit-switched argument was irrelevant to whether a network is a "paging" network or a "telephone" network.

GPNE next cites testimony that it argues establishes that the LTE network operates independently of the GSM network. GPNE JMOL Reply Br. at 14, citing Tr. at 1277:19–1282:24. GPNE highlights testimony in which Dr. Wilson confirms the contents of certain statements within DTX 400, an ETSI standard. This testimony concludes with the following: "Q: What it [DTX 400] says is you can implement an LTE data network without deploying a circuit switched network along with it; isn't that right? A: That's what it says, yes." Tr. at 1282:21–24. GPNE's argument thus assumes that telephone networks must be circuit switched, but Dr. Wilson disagreed with this argument. *Id.* at 1282:5–6. In order words, GPNE's argument relied on the proposition that all telephone networks are circuit switched, data networks such as LTE and GPRS operate independently of circuit switched networks, and therefore, LTE and GPRS operate independently of telephone networks. However, Dr. Wilson testified that "LTE is a telephone system and it's packet switched," which directly contradicts the assumption that all telephone systems must, by definition, be circuit switched. Tr. at 1282:5–6.

Furthermore, Dr. Wilson's earlier testimony on direct also confirmed that neither she, nor the Patent Office, found GPNE's packet-switched versus circuit-switched distinction relevant to the determination of whether a network is a "paging" or "telephone" network:

> Q: All right. Did the Patent Office make any – or did GPNE make any particular arguments about the difference in paging systems and telephone networks?
>
> A: They also referred to this idea of packet switch versus circuit switch.
>
> Q: And what was the Patent Office's reaction to that circuit switch versus packet switch distinction that GPNE was trying to make?
>
> A: The packet – the Patent Office said that that argument was irrelevant. They pointed out that there was no packet switching in the claims, so they did not buy that argument.
>
> . . . .
>
> Q: Dr. Wilson, what did you take from this statement from the Patent Office?

> A: So what I took from that was that the issue of packet switching and circuit switching was a non-issue. It was irrelevant.

Tr. at 1141:2–12; 1143:4–8 (objection omitted). In sum, the jury could have reasonably relied on (1) Dr. Wilson's testimony that LTE is both a telephone network and uses packet switching technology, which undermined the premise of GPNE's argument that all telephone networks must use circuit switching technology, or (2) on Dr. Wilson's testimony that GPRS, EDGE, and LTE "would not work" without the GSM network, which directly contradicted GPNE's claim that GPRS, EDGE, and LTE operate independently of the telephone network. Tr. at 1180:9–1181:4.

Accordingly, the Court concludes that a jury verdict of noninfringement based on the "operates independently" limitation is supported by substantial evidence. *See Callicrate*, 427 F.3d at 1366.

3. "Count Value"

The Court now turns to the second claim limitation that Apple identifies as one on which the jury could have reasonably relied in its finding of noninfringement: "count value."

The term "count value" appears in both the '492 and '954 Patents. The Court construed count value as "the number of consecutively related packets emanating from a transmitter." Order Construing Claims at 25. As described in this Court's claim construction order, the references to count value in the claims assume that the count value, i.e., the total number of packets in a message, is transmitted "to enable a receiving node in the plurality of nodes to determine when the first data packets being transmitted together are completely received." '267 Patent at 17:14–19; *see also* '954 Patent at 17:32–36. Indeed, the purpose of the count value is to allow the receiving node to determine when the last data packet in a transmission has been received, which the count value accomplishes by including a static number representing the total number of packets in a message. *See* Order Construing Claims at 25. GPNE contends that the GPRS countdown, with which the accused GPRS devices must be compatible, satisfies the "count value" limitation.

The Court finds that Apple provided substantial evidence that a GPRS countdown is not a "count value," nor is it information related to a "count value." At trial, Apple's expert, Dr. Wilson,

testified that the GPRS countdown is a flag that indicates when transmission of a message is complete. *See* Tr. at 1227:3–1230:3. When a message transmission is nearing its end, i.e., when the remaining number of data blocks remaining to be sent and received falls below a preset threshold, the GPRS countdown identifies the number of remaining blocks and begins "counting down" in each packet sequentially. Tr. at 1227:3–1228:3. Prior to that point, the GPRS countdown is always set to 15, regardless of the number of remaining blocks. Tr. at 1227:7–13. Dr. Wilson further testified that the count value in GPNE's patents described a static number representing the total number of packets in a message. Tr. at 1228:7–14. At trial, Dr. Wilson illustrated this distinction by describing a message containing 7 blocks of data: using a count value would result in the number 7 being included with each packet of data, but with a GPRS countdown, the first several packets would include the number 15, until the transmission hit a preset threshold of 5 blocks remaining, and then each packet of data would include the dynamic number of blocks remaining, e.g., 5, 4, 3, 2, 1. Tr. at 1227:3–1228:17; *see also* ADX 380, 382, 383.

GPNE does not dispute that the GPRS countdown is "not the equivalent to a countdown value," but argues that the GPRS countdown value is "calculated using information relating to the total number of packets." GPNE JMOL Br. at 24. According to GPNE, the fact that the GPRS countdown value contains information relating to the total number of consecutively related data packets is sufficient to satisfy the "count value" limitation. However, GPNE concedes that Dr. Wilson testified that it would be "impossible" to determine the total number of packets from the GPRS countdown, as that information is never transmitted. Tr. at 1229:14–18. According to Dr. Wilson, the GPRS countdown would never transmit a number representing the total number of packets in a message, only the number remaining when the message hit the preset threshold number. *Id.* The count value limitation, as construed, requires that the total number of packets in a transmission be transmitted to the receiver, "to enable a receiving node in the plurality of nodes to determine when the first data packets being transmitted together are completely received." '267 Patent at 17:14–19. The jury could have reasonably concluded, based on Dr. Wilson's testimony,

that the GPRS countdown does not transmit the total number of consecutive packets in the transmission to the receiver.

The Court therefore concludes that a jury verdict of noninfringement based on the count value limitation is supported by substantial evidence. *See Callicrate*, 427 F.3d at 1366.

4. Aligning/Clocking Signal

Next, the Court addresses the third claim limitation that Apple contends the jury could have reasonably relied upon in its finding of noninfringement: "aligning/clocking signal."

The term "clocking signal" also appears in both the '492 and '954 Patents. The Court construed clocking signal as "a signal that, among other things, contains timing information used for allocating resources." Order Construing Claims at 54. Dr. Dinan testified that because the accused Apple devices use the GSM and LTE standards, both of which include synchronization channels, the accused devices met this limitation. *See, e.g.*, Tr. at 599:12–25. As to GPRS products, Dr. Wilson testified that the accused Apple devices do receive a GSM synchronization burst ("GSM SCH burst"), but that this signal is distinct from a clocking or aligning signal as described by GPNE's patents. Tr. at 1221:1–8. Dr. Wilson provided two bases for this conclusion: (1) that GPNE made statements differentiating the GSM SCH burst from the aligning/clocking signal during the February 2013 reexamination of the '492 Patent; and (2) that the GSM SCH burst is a telephone signal. Tr. at 1218:3–1220:24; 1221:1–8.

With regard to the GPRS products, GPNE contends that Dr. Wilson's testimony relied solely on GPNE's statements during the February 2013 reexamination allegedly disclaiming the GSM "SCH burst." *See* GPNE JMOL Br. at 24–25. As a threshold matter, the Court previously concluded that GPNE "distinguish[ed] its clocking signal from the 'synchronization channel'/'SCH' 'burst,' a specific concept found in certain prior art." Order Construing Claims at 56. The Court further concluded that although that was the case, the Court was not persuaded that GPNE had "generally disclaimed" that the clocking/aligning signal could be used to synchronize devices with the controllers. *Id.* The Court construed clocking/aligning signal such that whether

other synchronization signals used in the GSM and LTE standards satisfied the limitation would be a question of fact for the jury to decide. The parties' experts agreed that the accused GPRS devices must receive the GSM SCH burst to comply with the GSM standard, but disagreed as to whether the GSM SCH burst conformed to the Court's construction of clocking/aligning signal. In light of conflicting expert testimony, the jury "was free to credit or discredit that testimony in rendering a verdict," and to consider GPNE's statements during the reexamination in deciding whether the GSM SCH burst satisfied the clocking/aligning signal limitation. *See Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1309 (Fed. Cir. 2011). Moreover, Dr. Wilson also explained that the GSM SCH burst is a telephone signal and thus does not satisfy the aligning/clocking limitation. Tr. at 1214:9–16.

GPNE does not raise any specific arguments as to the sufficiency of Dr. Wilson's testimony as to the accused LTE devices, but instead relies generally on Dr. Dinan's testimony to the contrary. *See* GPNE JMOL Br. at 24–25. As to the LTE accused products, Dr. Wilson testified that LTE synchronization involves two synchronization signals sent on 72 different frequencies. Tr. at 1222:2–10. According to Dr. Wilson, these two synchronization signals are insufficient to perform the claimed synchronization function. Tr. at 1222:23–1223:3. Dr. Wilson testified that the clocking/aligning signal, as construed by this Court, required multiple signals to perform the function of allocating resources, and that the two LTE synchronization signals were incapable of performing that function. Tr. at 1223:8–24. Dr. Wilson further explained that the LTE synchronization process would require different hardware than required for the clocking/aligning signal and would consume wider bandwidth. Tr. at 1223:25–1224:11. The jury could have reasonably concluded that neither the GPRS nor LTE accused products satisfied the clocking/aligning signal limitation based on Dr. Wilson's testimony.

In sum, the Court finds that there was substantial evidence to support a jury verdict of noninfringement as to the clocking/aligning signal limitation.

5. Differing Frequencies

The Court now turns to the fourth and final claim limitation that Apple argues the jury could have relied upon in finding noninfringement: "differing frequencies."

The term "four differing frequencies" appears in both the '492 and the '954 patents.[13] The specification describes the use of "four local frequencies for transmissions between pager units and a central control station." *See* '492 Patent at 1:66-2:1. As set forth in the specification, frequencies one and two are used to transmit downstream, from the control station to the paging unit, while frequencies three and four are used to transmit upstream, from the paging unit to the control station. *See id*. at 1:66–2:9. This four frequency system enables two-way data communications between the paging unit and the control station. *Id*. at 1:66–2:9.

Apple's noninfringement defense as to the "differing frequencies" limitation rested on the argument that the accused devices do not send and receive the four signals disclosed in the Asserted Patents, nor do the accused devices use a discrete frequency for each signal. Tr. at 1205:12–1206:15. At trial, Dr. Wilson testified that the four differing frequencies limitation appeared in each claim asserted, not only Claim 44. Tr. at 1206:10–12. Using Apple Demonstrative ADX-359, Dr. Wilson identified the four discrete signals described in the GPNE patents (clocking signal, first request signal, authorization signal, and communication message), and explained that LTE uses orthogonal frequency division multiplexing ("OFDM"), which involves sending multiple signals simultaneously over 72 separate frequencies. Tr. at 1209:16–1212:7. Rather than transmitting four discrete signals over four different frequencies, LTE sends "several signals," simultaneously over 72 frequencies. *Id.*; *see also* Apple Demonstrative 364 (and corresponding animation). According to Dr. Wilson, the LTE downlink and uplink signals engage in frequency hopping and do not conform to the four differing frequencies approach, as described in the asserted claims. Tr. at 1212:9–17.

GPNE raises two arguments: (1) that Dr. Wilson focused solely on the language of Claim

[13] The Court did not construe the term "differing frequencies." At *Markman*, the parties agreed to the construction of "frequency" as "a number expressed in hertz." Order Construing Claims at 19.

44, even though Claim 22 was the only claim asserted against the LTE devices; and (2) that Claim 22 "does not require four exact frequencies."[14] GPNE JMOL Br. at 25.

As to GPNE's first argument, the Court finds that Dr. Wilson testified that the four differing frequencies used to transmit the four signals recited in Claim 44 were also a limitation in Claim 22. Tr. at 1206:3–12. The language of the claims supports this interpretation. Claim 13 of the '954 Patent, from which Claim 22 depends, requires "wherein each of the clocking signal, the first request signal, the authorization signal, and the communication message are transmitted on **differing frequencies**." (emphasis added). Claim 37 of the '492 Patent, from which Claim 44 depends, requires "wherein the first frequency, the second frequency, the third frequency and the fourth frequency are **differing frequencies**." (emphasis added). The parties treated the four signals in the same manner for purposes of infringement, and it is unclear why the "differing frequencies" limitation in each claim would not also be treated as the same. While Dr. Dinan later stated without explanation that the differing frequencies requirement in Claim 22 was distinct from the differing frequencies requirement in Claim 44, *see* Tr. at 1558:12–15, during his initial testimony regarding the differing frequencies requirement, Dr. Dinan described it as "a limitation like before," and then proceeded to list the four distinct signals and the requirement that the signals be "transmitted on differing frequencies so they won't interfere." Tr. at 587:19–588:4. Dr. Dinan also explained the sequence of each signal. *See* Tr. 586:20–587:18 (describing the first signal, "next signal," "what happens after that," and "what is the final step"). Tr. at 586:20–587:18. Moreover, GPNE provides no citation to, and the Court did not find, any testimony from Dr. Dinan explaining why Claim 22 would not require four different signals, one for each of the four separate signals.

[14] GPNE did not address whether Apple presented sufficient evidence to support a jury finding of noninfringement based on the "differing frequencies" limitation with regard to GPRS products until its reply brief. *See* GPNE JMOL at 25; GPNE JMOL Reply at 15; *see also* Apple JMOL Opp. at 10. The Court declines to entertain an argument raised for the first time in GPNE's reply brief, especially in such a cursory manner. *See, e.g., Novosteel SA v. U.S., Bethlehem Steel Corp.*, 284 F.3d 1261, 1273–75 (Fed. Cir. 2002).

Furthermore, to the extent GPNE now contends for the first time that the differing frequencies limitation requires only a minimum of four frequencies, rather than four exact frequencies, the Court notes that this argument is ultimately unavailing. Dr. Wilson also testified that LTE ODFM sends multiple signals out simultaneously on 72 different frequencies and uses "frequency hopping," which would allow two or more signals to transmit in the same frequency. Tr. at 1209:16–1212:7. Dr. Wilson contrasted LTE ODFM to the differing frequencies limitation based not only on the difference in number, 4 or 72, but also based on the simultaneous transmission and frequency hopping. *Id.* The jury could have reasonably concluded, based on Dr. Wilson's testimony, that the accused LTE devices did not meet the differing frequencies limitation.

In sum, the Court concludes that a jury verdict of noninfringement based on the four limitations discussed above is supported by substantial evidence. *See Callicrate*, 427 F.3d at 1366. The Court also finds that the jury could have reasonably concluded that GPNE failed to satisfy its burden of proof as to infringement because the jury discredited GPNE's expert as to infringement. The Court therefore denies GPNE's motion for judgment as a matter of law as to infringement, or in the alternative, for a new trial.

IV. APPLE'S MOTION FOR JUDGMENT AS A MATTER OF LAW AS TO INDEFINITENESS

Apple renews its motion for judgment as a matter of law as to invalidity based on indefiniteness. ECF No. 574, Apple Indefiniteness JMOL at 2. The Court allowed the parties to engage in supplemental expert discovery on indefiniteness in light of the Supreme Court's decision in *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120 (2014). *See* ECF No. 327 (Pretrial Conference Order) at 2. The Court noted that "[a]ny indefiniteness issues will be decided by the Court, and not tried to the jury." *Id.* The parties stipulated to Apple preserving its defense until after trial. *See* ECF 576 (GPNE Indefiniteness Opp.) at 2. Apple now moves for judgment as a matter of law based on indefiniteness because a person "of ordinary skill in the art could not

determine the scope of the phrase 'randomly generated information' with reasonable certainty." Apple Indefiniteness JMOL at 2.

A. Legal Standard on Indefiniteness

Under 35 U.S.C. § 112, ¶ 2 (2006 ed.),[15] a patent must "conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as [the] invention." Section 112, ¶ 2 includes what is commonly called the "definiteness" requirement. *Nautilus*, 134 S. Ct. at 2125. Prior to the Supreme Court's decision in *Nautilus*, the Federal Circuit applied an "insolubly ambiguous" standard to indefiniteness questions. *See, e.g.*, *Datamize, LLC v. Plumtree Software*, Inc., 417 F.3d 1342, 1347 (Fed. Cir. 2005). Under the insolubly ambiguous standard, a claim failed to meet § 112, ¶ 2, and was indefinite only when it was "not amenable to construction" or "insolubly ambiguous." *Id.* In *Nautilus*, the Supreme Court rejected the insolubly ambiguous standard and replaced it with a "reasonable certainty" standard, holding that "a patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus*, 134 S. Ct. at 2124. In addition to the specification, "an ordinarily skilled artisan must consult the prosecution history to confirm the proper understanding of a claim term's meaning, especially if other aspects of the inquiry raise questions." *Ancora Techs., Inc. v. Apple, Inc.*, 744 F.3d 732, 738 (Fed. Cir. 2014).

The Court therefore reviews the claims, specification, prosecution history, and extrinsic evidence to determine whether the claims "inform, with reasonable certainty, those skilled in the art about the scope of the invention." *Nautilus*, 134 S. Ct. at 2124. Indefiniteness renders a claim invalid, and must be shown by clear and convincing evidence. *See Halliburton Energy Servs. v. M-I LLC*, 514 F.3d 1244, 1249 (Fed. Cir. 2008); *cf. Nautilus*, 134 S. Ct. at 2130 n.10.

[15] Paragraph 2 of 35 U.S.C. § 112 was replaced with newly designated § 112(b) when § 4(c) of the America Invents Act ("AIA"), Pub. L. No. 112-29, took effect on September 16, 2012. Because the applications resulting in the patents at issue in this case were filed before that date, the Court refers to the pre-AIA version of § 112.

B. The Term "Randomly Generated Information" is Not Indefinite

Claim 44 of the '492 Patent and Claims 19 and 22 of the '954 Patent require that the "node" receive "randomly generated information." The Court construed that phrase as "information that is randomly generated." Order Construing Claims at 19–24. Apple contends that the asserted claims are invalid for indefiniteness because one of ordinary skill in the art could not determine what degree of "randomness" is necessary to satisfy the construction, or how to generate that "random" information.

1. The Claims Are Not Indefinite For Failing to Specify a Degree of Randomness

The Court begins by examining the claim language itself. Claim 19 of the '954 Patent provides:

> 19. The first node of claim 18, wherein the interface is further controlled by the processor to:
>
> > transmit randomly generated information created by the first node; and
> >
> > receive said randomly generated information returned from the communication controller to enable identification of the first node.

'954 Patent, cl. 19. The claim thus describes "randomly generated information" that is used for the purpose of enabling identification of the first node.[16] Therefore, the appropriate inquiry here is whether one skilled in the art would, in light of the specification, be able to determine the scope of the claims with reasonable certainty, given that the randomly generated information must be sufficient to enable identification of the first node. *Nautilus*, 134 S. Ct. at 2124; *see also Biosig Instruments, Inc. v. Nautilus*, 783 F.3d 1374 (Fed. Cir. 2015) (*Nautilus* remand).

Apple argues that one of ordinary skill in the art could not determine what degree of "randomness" is necessary to satisfy the construction. At trial, Apple's expert, Mr. Rysavy, testified that "randomly generated information" encompasses various types of information, of

[16] Apple attempts to ignore this qualifier by arguing that "randomly generated information" is used in the claims without this limitation. *See* ECF No. 581 (Apple Indefiniteness Reply) at 2. This is not persuasive, as the purpose of the randomly generated information is clear from the claim.

varying degrees of randomness. Tr. at 1359:11–1360:6. According to Mr. Rysavy, "randomly generated information" encompasses nondeterministic information, random information produced using non-computer methods, and random information deterministically produced using computer methods. *Id.* Mr. Rysavy explained that it would be "extremely difficult" to generate completely random information. *Id.* Moreover, Apple contends that the phrase "randomly generated information" is subjective because a skilled artisan would recognize that "different applications may require a different level of 'randomness.'" Apple Indefiniteness JMOL at 6. As Apple explains it, as the number of pagers in the system increase, the corresponding degree of randomness would also have to increase. Apple Indefiniteness Reply at 3.

Apple's indefiniteness arguments assume that "randomly generated information" is a term of degree. Apple is incorrect. The claims require that the information be random, but do not require any particular degree of randomness. Apple appears to argue that the mere fact that randomness can be described in degrees renders the term "randomly generated information" a term of degree. However, Apple fails to identify any indication in the claim language itself that the degree of randomness is relevant to the scope of the claims.[17] The Court finds no other indications that "randomly generated information" is a term of degree, such as the presence of a qualifier such as "relatively" or "substantially." *See, e.g.*, *Datamize*, 417 F.3d at 1351 (noting "substantially equal to", "about", and "substantial absence" are terms of degree), *abrogated on other grounds by Nautilus*, 134 S. Ct. 2120; *see also Affymetrix, Inc. v. Hyseq, Inc.*, 132 F. Supp. 2d 1212, 1229 (N.D. Cal. 2001) (identifying "about," "relatively," "partially," and "substantially" as terms of degree).

Moreover, even if the Court agreed with Apple that "randomly generated information" is a

[17] The Court notes that Apple itself appeared to understand "randomly" to be an attribute that is either present or not, rather than a term of degree. At *Markman*, Apple argued for "randomly generated information" to be construed as "identification of the *randomly* selected timeslot." *Markman* Tr. at 19 (emphasis added). Apple seemed to have no difficulty understanding the scope of "randomness" in that context.

term of degree, that would not alter the Court's conclusion that the claims are not indefinite. As the Federal Circuit explained in *Interval Licensing LLC v. AOL, Inc.*, 766 F.3d 1364, 1370 (Fed. Cir. 2014), terms of degree are not inherently indefinite and "absolute or mathematical precision is not required." So long as the claims, when viewed in light of the specification and prosecution history, provide "objective boundaries" for those of skill in the art, the claims are not indefinite. *Id.* at 1371.

In the instant case, the Court concludes that GPNE was not required to list all possible degrees of randomness or methods of generating random information in order to satisfy § 112, ¶ 2. As implied by Apple's own argument, it is evident from the specification that the claims may encompass more or less complicated systems that would require varying degrees of randomness. *See, e.g.*, '492 Patent at 1:66–2:17.

Moreover, as GPNE explains, it would be evident to a person skilled in the art that the specific degree of randomness is not relevant to understanding the scope of the claims. *See Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1575–76 (Fed. Cir. 1986). That GPNE's claims encompass situations involving both lesser and greater degrees of randomness goes to the breadth of the claims, not their definiteness. Apple cannot contest that breadth of scope is not equivalent to indefiniteness. "Merely claiming broadly" does not "prevent the public from understanding the scope of the patent." *Ultimax Cement Mfg. Corp. v. CTS Cement Mfg. Corp.*, 587 F.3d 1339, 1352 (Fed. Cir. 2009); *SmithKline Beecham Corp. v. Apotex Corp.*, 403 F.3d 1331, 1341 (Fed. Cir. 2005) ("[B]readth is not indefiniteness." (quotation and citation omitted)). A broad claim can be definite even where there is no precise numerical boundary so long as a person of skill in the art can determine the scope with reasonable certainty. *See Enzo Biochem, Inc. v. Applera Corp.*, 599 F.3d 1325, 1335 (Fed. Cir. 2010); *Nautilus*, 134 S. Ct. at 2124.

In addition to the clarity provided by the claims and specification, Apple's expert, Mr. Rysavy, appeared to have little difficulty understanding the scope of the term "randomly generated information" during his testimony regarding obviousness. When asked whether he could find a

signal including "random information" in the prior art, Mr. Rysavy stated "yes" and identified "five bits of random information, which is a way of temporarily identifying the phone." Tr. at 1358:21–1359:2. Mr. Rysavy did not hesitate, qualify, or otherwise evince uncertainty in identifying this limitation in the prior art, and identified it with more than reasonable certainty.

Mr. Rysavy's testimony supports the conclusion that a person skilled in the art can determine the scope of this term, as he was able to confidently identify GSM prior art that met the "randomly generated information" claim element. Tr. at 1360:17–21 ("The GSM prior art provides sufficient information to address [the randomness] claim element."). This testimony suggests that a person skilled in the art could determine, with reasonable certainty, the scope of GPNE's claims. *See Nautilus*, 783 F.3d at 1382 (applying "reasonable certainty" standard to conclude that an "ordinarily skilled artisan" would understand the scope of the invention based on intrinsic and extrinsic evidence); *see also Rosemount, Inc. v. Beckman Instruments, Inc.*, 727 F.2d 1540, 1547 (Fed. Cir. 1984); *see also Chiron Corp. v. Genentech, Inc.*, No. CIV.S-00-1252 WBSGGH, 2002 WL 32123928, at *5 (E.D. Cal. June 24, 2002).

In opposition, Apple argues that Mr. Rysavy testified only to the prior art equivalent to the allegedly infringing products and did not actually interpret "randomly generated information." Apple Indefiniteness Reply at 8–9. This argument is belied by the substance of Mr. Rysavy's testimony, which directly compared the prior art to the claim terms. In order to determine whether the claims were invalid due to the identified prior art, Mr. Rysavy had to compare the prior art to the claims. Although Mr. Rysavy testified as to the complexity of defining "randomly generated information" in the abstract, he was clearly able to identify that same randomly generated information in the GSM prior art. Tr. at 1358:21–1359:2, 1360:17–21. Mr. Rysavy's ability to testify as to his opinion that GPNE's claims were invalidated by prior art strongly supports the inference that Mr. Rysavy understood the scope of "randomly generated information."

As discussed above, the Court concludes that "randomly generated information" is sufficiently clear to provide "clear notice of what is claimed," i.e., the information used must be

random, and it must enable identification of the first node. *See, e.g.*, '954 Patent, Cl. 19.

2. Apple's Arguments Related to "Generating" Random Information go to Enablement, not Indefiniteness

Finally, the Court notes that much of Apple's argument and Mr. Rysavy's testimony focused on the claims' supposed failure to disclose *how* to generate the random information required. *See, e.g.*, Apple Indefiniteness JMOL at 6 ("The GPNE patents fail to define . . . how a person of ordinary skill would go about 'randomly generat[ing] information.'"); Tr. at 1359:17–1360:6 (Q:"And does the patent tell us anything about how to [generate random information]?" A: "It does not."). Based on Apple's arguments, the Court agrees with GPNE that Apple's contention is nothing more than a veiled attempt to argue enablement. As Apple's argument is based on enablement, rather than indefiniteness, it is not appropriate for resolution in this motion. *See, e.g.*, *Augme Technologies, Inc. v. Yahoo! Inc.*, 755 F.3d 1326, 1340 (Fed. Cir. 2014) (rejecting purported indefiniteness challenge because it was an enablement argument). The Court granted GPNE's motion for JMOL on an enablement defense based on Apple's failure to present any evidence as to enablement during trial and Apple's decision not to oppose GPNE's JMOL motion as to enablement. *See* ECF No. 576. Having conceded that argument during trial, Apple may not now use an indefiniteness challenge to argue enablement.

The Court does note that the patent does not claim a means to randomly generate information, and Apple does not otherwise explain why the patents must disclose such a means in order to make the term "randomly generated information" definite. As both parties note, the use of randomly generated information was well known at the time of the invention. *See* Apple Indefiniteness Reply at 3 (discussing Heide patent, DTX 23); GPNE Indefiniteness Opp. at 10–11 (also discussing Heide patent). The Court therefore can find no reason why the Asserted Patents' failure to disclose how to randomly generate information impacts one's ability to determine, with reasonable certainty, the scope of the claims.

In sum, the Court concludes that a person of ordinary skill in the art could determine with

reasonable certainty the scope of GPNE's claims and their reliance on "randomly generated information." The Court therefore denies Apple's motion for judgment as a matter of law as to indefiniteness. *Biosig*, 783 F.3d at 1384.

V. CONCLUSION

For the reasons stated above, the Court DENIES GPNE's motion for judgment as a matter of law, or in the alternative a new trial, and DENIES Apple's motions for judgment as a matter of law.

IT IS SO ORDERED.

Dated: June 9, 2015

LUCY H. KOH
United States District Judge

United States District Court
Northern District of California

Exhibit 3

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

GPNE Corp., Plaintiff, v. Apple, Inc., Amazon.com, Inc., Nokia Corp., Nokia Inc., Pantech Co. Ltd., and Pantech Wireless, Inc. Defendants.	Case No.: 12-CV-02885-LHK and Related Case Nos. 12-CV-03055-LHK, 12-CV-03056-LHK, and 12-CV-03057-LHK ORDER CONSTRUING CLAIMS

Plaintiff GPNE Corp. ("GPNE") brings this action for patent infringement against Defendants Apple Inc. ("Apple"), Amazon.com, Inc. ("Amazon"), Nokia Corp and Nokia Inc. ("Nokia") and Pantech Co. Ltd. and Pantech Wireless, Inc. ("Pantech") (collectively, "Defendants"). The parties now seek construction of nine disputed terms used in the claims of the following patents-in-suit: U.S. Patent Nos. 7,555,267 ("'267 Patent"), 7,570,954 ("'954 Patent"), and 7,792,492 ("'492 Patent") (collectively, "Patents").[1]

I. BACKGROUND

A. Background and Description of the Invention

The Patents in in this matter claim priority to a June 1994 application. *See* '267 Patent, Related U.S. Application Data (stating that the '267 Patent is a continuation of several previous

[1] The '267 Patent is attached as Exhibit A to the Declaration of Steven W. Hartsell, ECF No. 69-1. The '954 Patent is attached as Exhibit B. The '492 Patent is attached as Exhibit C.

applications, the first of which is a divisional of "application No. 08/264,973, filed on Jun. 24 1994, now Pat. No. 5,542,115"); '954 Patent (same); '492 Patent (same). The June 1994 application, which is now Patent No. 5,542,115, pertains to "[a] two-way paging system [which] utilizes four local frequencies for transmissions between pager units (**22**) and a central control station (**20**)." *See* Declaration of Christopher O. Green in Support of Defendants' Claim Construction Brief, ECF No. 72-1 ("Green Decl."), Ex. 1 ("'115 Patent"), Abstract (emphasis in original). The instant Patents each share the same specification, and this specification is nearly identical to the '115 Patent's specification. *See* '267 Patent; '954 Patent;'492 Patent; '115 Patent.

As set forth in the specification for the Patents, the "invention pertains to communications paging, and particularly to two-way paging method and apparatus." *See* '267 Patent at 1:32-33; *see also id.* at 1:66-67 (describing "[a] two-way paging system [that] utilizes four local frequencies for transmissions . . . ."); *id.* at 14:14-15 ("[T]he invention provides a two-way paging system . . . ."). The specification describes the use of "four local frequencies for transmissions between pager units and a central control station." *Id.* at 1:66-2:1. As set forth in the specification, frequencies one and two are used to transmit downstream, from the control station to the paging unit, while frequencies three and four are used to transmit upstream, from the paging unit to the control station. *See id.* at 1:66-2:9.

Turning to the claims in the Patents, the '267 Patent includes claims directed towards apparatuses which the claims refer to as "node[s]." For example, the '267 Patent claims:

> 1. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:
>
> at least one processor;
>
> a memory providing code to the least one processor; and
>
> an interface controlled by the least one processor to:
>
> transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;
>
> receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for transmitting first data packets containing a message;

…

See id. at 14:60-15:21.

The '267 Patent also includes several claims directed towards "controller[s]." For example, the '267 Patent claims:

> 25. A controller in a network including a plurality of nodes, the controller comprising:
>
> at least one processor;
>
> a memory providing code to the at least one processor; and
>
> at least one interface controlled by the at least one processor to:
>
> receive a random access request signal transmitted by a first node in the plurality of nodes in a first slot, the random access request signal including information that allows the controller to determine that the first node requires an allocation of resources to transmit a reserve access request signal;
>
> transmit a first grant signal subsequent to receipt of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for transmitting first data packets containing a message;
>
> receive the reserve access request signal from the first node subsequent to transmission of the first grant signal;
>
> transmit a second grant signal subsequent to receipt of the reserve access request signal from the first node, said second grant signal including information related to an allocation of additional resources to the first node for transmitting the first data packets, said second grant signal including information related to a third slot wherein a second node may transmit a request signal; and
>
> receiving first data packets from the first node subsequent to transmission of the second grant signal, wherein the first data packets are received from the first node during reception of a request signal from the second node provided in a third slot.

Id. at 16:64-17:30.

The '954 and '492 Patents also include claims for nodes and controllers. *See* '954 Patent at 17:34-50 (Claim 12 for "communication controller"); *id.* at 17:58-18:15 (Claim 23 for "[a] first node"); '492 Patent at 15:41-16:15 (Claim 2 for "[a] first node"); *id.* at 16:58-17:33 (claiming "[a] controller"). The '954 and '492 Patents additionally include various method claims which are generally directed towards methods for conducting communications between the claimed nodes and controllers. For example, the '492 Patent claims:

> 1. A method of operating a data communication system, the data communication system including at least a first communication controller and at least a first node, the method comprising:
>
> transmitting a random access connection request signal from the first node to the first

communication controller in a first slot indicating that the first node can receive messages transmitted from the first communication controller;

receiving a connection request response signal from the first communication controller transmitted to the first node in response to the random access connection request signal, said connection request response signal providing information indicating that the first node can transmit a reserve access request signal in a second slot in order to subsequently transmit a message to the first communication controller;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmitting the reserve access request signal in the first slot in response to the connection request response signal from the first communication controller;

receiving a grant signal from the first communication controller subsequent to transmission of the reserve access request signal, said grant signal including information indicating resources have been allocated for transmission of message data packets to the first communication controller;

transmitting the message data packets from the first node in response to the grant signal;

wherein the message data packets comprise multiple data packets, wherein at least one [sic] the message data packets contain information related to a count value, wherein the final data packet from the multiple data packets contains terminal indication information indicating that termination of the message data packets has occurred;

wherein a subsequent reserve access request signal from a second node provided in a third slot assigned to the second node can be transmitted during transmission of the message data packets by the first node; and

wherein the aligning signal is received on first frequency, the reserve access request signal is transmitted on a second frequency, the grant signal is received on a third frequency and the message data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

Id. at 14:59-15:40.

B. Claim Terms at Issue

In the parties' Joint Claim Construction Statement, the parties identified nine claim terms to be construed:

1. "node";
2. "frequency";
3. "randomly generated information";
4. "count value";
5. "providing code to";

6. "first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal";
7. "interface [configured/controlled] by the at least one processor to [functional language]";
8. "allocation of additional resources for transmitting the data packets/allocation of additional resources for transmitting the first data packets";
9. "clocking signal"

See ECF No. 66 ("Joint Claim Construction Statement" or "JCCS") at 4.[2]

A. Procedural Background

On July 1, 2011, GPNE filed a Complaint in the District of Hawaii against each of the Defendants, as well as Barnes & Noble, Sharp Company, and several other Defendants. *See GPNE v. Amazon.com, Inc.*, Case No. 11-CV-00426-JMS-RLP (D. Haw. 2011). Subsequently, the District Court in Hawaii severed the GPNE's cases against each of the Defendants in the Hawaii action and transferred several of the separate actions to the instant Court. *See id.*, ECF Nos. 246, 295; *GPNE Corp. v. Nokia Corp.*, Case No. 12-CV-00250-SOM-RLP, ECF No. 14; *GPNE Corp. V. Pantech Co., Ltd. and Pantech Wireless, Inc*., Case No. 12-CV-00251-SOM-RLP, ECF No. 10. After the actions against the instant Defendants were transferred to the Northern District of California, this Court related the cases. *See GPNE v. Apple, Inc.*, Case No. 12-CV-2885-LHK-PSG, ECF No. 35[3] (N.D. Cal. 2012).

On April 15, 2013, GPNE filed its Opening Brief on Claim Construction. ECF No. 69 ("Opening Br." or "Opening Brief"). On April 29, 2013, Defendants filed their joint responsive Claim Construction Brief. *See* ECF No. 72 ("Responsive Brief" or "Resp. Br."). On May 10, 2013, GPNE filed its Reply Brief. *See* ECF No. 75 ("Reply Brief" or Reply Br."). The Court held

[2] In the Joint Claim Construction Statement, the parties also identified four terms upon whose construction the parties agree. Specifically, the parties agree that the term "downstream" should be construed as "in the direction from controllers to nodes"; the term "upstream" should be construed as "in the direction from nodes to controllers"; and the term "simultaneous with" should be construed as "at the same time." JCCS at 3. In addition, the parties have agreed that the construction of the term "aligning signal" should be the same as the construction for "clocking signal," which the parties have identified for construction by the Court. *See id*. The Court hereby adopts these constructions.

[3] All future references to Docket Numbers refer to Case No. 12-CV-2885 unless otherwise specified.

a tutorial and claim construction hearing on June 6, 2013 ("*Markman* hearing").

II. LEGAL STANDARD

Claim construction is a question of law to be determined by the court. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). "Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1316 (Fed. Cir. 2005) (en banc) (internal quotation marks and citation omitted). Accordingly, a claim should be construed in a manner that "stays true to the claim language and most naturally aligns with the patent's description of the invention." *Id.*

In construing disputed terms, a court looks first to the claims themselves, for "[i]t is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Id.* at 1312 (quoting *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). Generally, the words of a claim should be given their "ordinary and customary meaning," which is "the meaning that the term[s] would have to a person of ordinary skill in the art in question at the time of the invention." *Id.* at 1312-13. In some instances, the ordinary meaning to a person of skill in the art is clear, and claim construction may involve "little more than the application of the widely accepted meaning of commonly understood words." *Id.* at 1314.

In many cases, however, the meaning of a term to a person skilled in the art will not be readily apparent, and a court must look to other sources to determine the term's meaning. *See Phillips*, 415 F.3d at 1314. Under these circumstances, a court should consider the context in which the term is used in an asserted claim or in related claims, bearing in mind that "the person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Id.* at 1313. Indeed, the specification "'is always highly relevant'" and "'[u]sually . . . dispositive; it is the single best guide to the meaning of a disputed term.'" *Id.* at 1315 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). Where the specification reveals that the patentee has given a special definition to a claim term that differs

from the meaning it would ordinarily possess, "the inventor's lexicography governs." *Id.* at 1316. Likewise, where the specification reveals an intentional disclaimer or disavowal of claim scope by the inventor, the inventor's intention as revealed through the specification is dispositive. *Id.*

A court may also consider the patent's prosecution history, which consists of the complete record of proceedings before the United States Patent and Trademark Office ("PTO") and includes the cited prior art references. *Phillips*, 415 F.3d at 1317. The court may consider prosecution history where it is in evidence, for the prosecution history "can often inform the meaning of the claim language by demonstrating how the inventor understood the invention and whether the inventor limited the invention in the course of prosecution, making the claim scope narrower than it otherwise would be." *Id.*

Finally, a court also is authorized to consider extrinsic evidence in construing claims, such as "expert and inventor testimony, dictionaries, and learned treatises." *Markman*, 52 F.3d at 980. Expert testimony may be particularly useful in "[providing] background on the technology at issue, . . . explain[ing] how an invention works, . . . ensur[ing] that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or . . . establish[ing] that a particular term in the patent or the prior art has a particular meaning in the pertinent field." *Phillips*, 415 F.3d at 1318. Although a court may consider evidence extrinsic to the patent and prosecution history, such evidence is considered "less significant than the intrinsic record" and "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id.* at 1317, 1318 (internal quotation marks and citations omitted). Thus, while extrinsic evidence may be useful in claim construction, ultimately "it is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence." *Id.* at 1319. Any expert testimony "that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history" will be significantly discounted. *Id.* at 1318 (internal quotation marks and citation omitted). Finally, while the specification may describe a preferred embodiment, the claims are not necessarily limited only to that embodiment. *Phillips*, 415 F.3d at 1323; *see also Prima Tek II, L.L.C. v. Polypap, S.A.R.L.*, 318 F.3d 1143, 1151 (Fed. Cir. 2003) ("The general rule, of course, is that claims of a patent are

not limited to the preferred embodiment, unless by their own language.").

III. DISCUSSION

A. "node"

Terms in Dispute	GPNE's Proposed Construction	Defendants' Proposed Construction
"node"	"A device in a network that can transmit and receive information"	"A pager in a network operating independently of a telephone network"[4]

The term "node" appears throughout the three Patents. For example, the '267 Patent claims:

> 1. A first **node** in a data network, the data network including a plurality of **nodes** including a first **node**, the first **node** comprising:
>
> at least one processor;
>
> a memory providing code to the least one processor; and
>
> an interface controlled by the least one processor to:
>
> transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first **node** requires an allocation of resources to transmit a reserve access request signal;
>
> receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first **node** for transmitting the reserve access request signal for transmitting first data packets containing a message;
>
> transmit the reserve access request signal in the second slot in response to the first grant signal;
>
> receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an allocation of additional resources for transmitting the first data packets; and
>
> transmit the first data packets in response to the second grant signal, wherein the first data packets can be transmitted during transmission of a request signal by a second **node** into a third slot assigned to the second **node**.

See id. at 14:60-15:21 (emphasis added).

GPNE argues that "node" should be construed as "a device in a network that can transmit and receive information." *See* Opening Br. at 3. Defendants argue that "node" should be

[4] Defendants' original proposed construction did not include "in a network." Opening Br. at 3. However, in Defendants' Responsive Brief, Defendants agreed that the node must be "in a network" and that this language may be included in the construction. *See* Resp. Br. at 4 n.4.

construed as "a pager in a network operating independently of a telephone network." *See* Resp. Br. at 4. Thus, the parties dispute whether the node must: (1) be a "pager" or whether it may be any "device," and (2) "operat[e] independently of a telephone network."

For the reasons set forth below, the Court construes "node" as meaning "pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network." The Court addresses in turn whether: (1) a "node" is simply a "device in a network" or whether the "node" is a "pager," and (2) the "node" must "operat[e] independently of a telephone network."

1. Intrinsic Evidence

a) Claim Language

At the outset, the Court observes that the claim language on its face does not use the term "pager." Rather, the claim language only describes a "node." *See, e.g.*, '267 Patent at 14:60-15:21. Thus, on its face, the claim language is more consistent with GPNE's proposed construction wherein "node" simply means "[a] device in a network that can transmit and receive information" and does not require a specific kind of device such as a "pager." However, claims must be read "light of the specification . . . ." *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1257 (Fed. Cir. 1989). Accordingly, the Court proceeds to consider the specification.

b) Specification

When the term "node" is construed in light of the specification, it becomes clear that the "node" is a type of "pager" and not simply a device in a network.

Notably, beyond the claim language, the term "node" appears *only* in the Abstracts for each of the three Patents. *See e.g.*, '267 Patent, Abstract ("A network node in a communication system makes two reservation requests…."); '492 Patent, Abstract; '954 Patent, Abstract. The remainder of the specification explicitly describes the devices claimed in the Patents as a type of pager and makes clear that the invention was designed to address shortcomings in 1990s[5] pager systems.

For example, the "Technical Field" portion of the specification states that "*this invention* pertains to communications paging, and particularly to two-way paging method and apparatus."

[5] *See* '115 Patent (filed June 24, 1994).

'267 Patent at 1:32-33 (emphasis added); *see also id.* at 14:14-15 ("[T]he invention provides a two-way paging system . . . ."). Likewise, under the "Summary" heading, the specification describes "[a] two-way paging system [that] utilizes four local frequencies for transmissions…." *Id.* at 1:66-67. These statements strongly support the proposition that "node" claimed in the patents is a type of "pager." *See Verizon Servs. Corp. v. Vonage Holdings Corp.*, 503 F.3d 1295, 1308 (Fed. Cir. 2007) ("When a patent thus describes the features of the 'present invention' as a whole, this description limits the scope of the invention."); *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1343 (Fed. Cir. 2001) ("[T]he characterization of the coaxial configuration as part of the 'present invention' is strong evidence that the claims should not be read to encompass the opposite structure.").

The "Related Art" section similarly supports the conclusion that the claimed invention is a type of pager system. The "Related Art" section discloses that pager systems of the mid-1990's were limited in that they could only engage in one-way communications, *i.e.*, they could receive data but could not return data. *See* '267 Patent at 1:41-44. Prior art had attempted to address the lack of two-way communication capabilities by "connect[ing] the pager to a telephone" or mobile phone. *Id.* at 1:44-51. The specification acknowledges that some prior art pagers included an ability to send an acknowledgement or response to a paging system. *Id.* at 1:52-62. However, these systems required the use of "numerous frequencies or frequency sub-bands" which made transitioning between areas "served by differing central stations . . . cumbersome." *Id.* It therefore appears clear from the descriptions of the Related Art that the inventions disclosed in the Patents are intended to address shortcomings in contemporary pager systems. This factor adds further support to the conclusion that the "node" is a type of "pager." *See CVI/Beta Ventures, Inc. v. Tura LP*, 112 F.3d 1146, 1160 (Fed. Cir. 1997) (noting that "[i]n construing claims, the problem the inventor was attempting to solve, as discerned from the specification and the prosecution history, is a relevant consideration"); *cf. Corning Glass Works*, 868 F.2d at 1257 (holding that the phrase "[a]n optical waveguide" in the preamble of the claim language was meant to limit claim scope to "optical waveguides" rather than all optical fibers because the "specification [made it] clear that the inventors were working on the particular problem of an . . . optical communication system not on

general improvements in conventional optical fibers").

Finally, the Court observes that the two exemplary embodiments described in the specification repeatedly refer to "pager unit[s]." *See, e.g.*, '267 Patent at 4:31-32 ("Communication between central control station **20** and pager unit **22** occurs on the four local frequencies . . . ."); *id.* at 9:13-15 ("FIG **8** shows a paging unit **422** suitable for use with central control station 420."). Similarly, the associated figures describe the device using terms such as "pager," and "pager receiver." *See, e.g., id.*, Figs. 2, 5, and 8. Indeed, the generic term "device" is used to describe the claimed invention only once, and in the relevant sentence, the device is also described as a "pager." *See id.* at 5:22-23 ("The transmitting device (either central station **20** or pager **22**) . . . .").

The Court acknowledges that, ordinarily, limitations set forth in a preferred embodiment disclosed in a specification do not limit the scope of the claims. *See, e.g., Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 908 (Fed. Cir. 2004). However, here, not only do the embodiments consistently refer to the claimed communication devices as pager units, the remainder of the specification similarly states that the claimed devices are pagers. Under these circumstances, the description of the devices as a pager unit in the embodiments supports the conclusion that the nodes are a type of pager. *See In re Abbott Diabetes Care Inc.*, 696 F.3d 1142, 1149 (Fed. Cir. 2012) (holding that the conclusion that the claimed electrochemical sensor could not have external wires was supported by: (1) "every embodiment disclosed in the specification shows . . . [a] sensor without external cables or wires," and (2) the discussion of the prior art in the specification identified external cables or wires as a deficiency in the prior art supported). Thus, the specification supports the conclusion that the claimed device is a type of pager.

The specification further supports the conclusion that the term "pager" refers to a type of device that has qualities that distinguish it from other types of devices such as telephones. For example, while not referring directly to pager units, the specification states that the claimed "two-way paging system [would] operate[] independently from [the] telephone system." *See* '267 Patent at 14:14-15. Similarly, the specification indicates that pager messages and telephone messages are distinct. *See id.* at 5:31-35 ("Central computer **30** can distinguish between receipt of a telephone message… and a pager message . . . by virtue of the fact that I/O interface **52** generates different

types of interrupts to CPU **50** depending on the type of message received."). Likewise, in the portion of the specification discussing the prior art, the terms "pager" and "telephone" are used to refer to different devices. *See id.* at 1:44-46 (stating that "[p]rior art attempts to provide two-way communication capabilities for a pager have included efforts to connect the pager to a telephone"). Thus, the specification supports the conclusion that the term "pager" does not simply refer to a device in a network but rather to a device designed to operate in a particular kind of system. Consequently, an accurate construction of "node" should disclose that the node is a type of pager and not merely a device in a network.

GPNE argues that Defendants' construction, wherein "node" refers to a "pager," should nevertheless be rejected because the specification makes it clear that "the devices contemplated in the Patents are . . . not the *mere* 'pagers' of [the] time." Opening Br. at 4 (emphasis added). GPNE argues that the discussion of the prior art in the specification confirms that the term "pagers" means "historical one-way pagers." *See id.*; '267 Patent at 1:30-62 (noting that "[p]aging systems have historically been one-way systems" and describing "[p]rior art attempts to provide two-way communication capabilities for a pager . . . [by] connect[ing] the pager to a telephone"). GPNE argues that the specification describes an "enhanced device[] that . . . the specification calls [a] 'pager unit[]'," and that, accordingly, it would be improper to describe the "node" as a "pager." *See* Opening Br. at 4. GPNE's argument is not persuasive.

As an initial matter, GPNE cited no evidence in the specification indicating that the use of the term "pager unit" was a deliberate attempt to distinguish the claimed devices from ordinary "pagers." Indeed, Figure 2, which is referenced in the specification as providing "a schematic view" of the "pager unit," *see* '267 Patent at 2:31, simply describes the device as a "pager." *See id.*, Fig. 2. Moreover, even if "pager unit" was meant to distinguish the claimed invention from traditional pagers, the use of the term "pager unit" acknowledges that the claimed invention is a type of pager. Furthermore, while the Court agrees that the specification makes clear that the claimed invention is distinguishable from prior art pagers in that the claimed devices are capable of two-way communications, this does not support the conclusion that the claimed devices are not a type of pager. Nor does the distinction between prior art pagers and the claimed pager units

support the conclusion that the term "node" should be construed as referring to *any* "device in a network that can transmit and receive information." *See* Opening Br. at 4. At best, the fact that the claimed pager units are capable of two-way communications supports amending Defendants' proposed construction to clarify that the "node" is a "pager" with *two-way communications capability*. The Court will include this limitation in its construction.

In light of the description of the claimed invention as a "paging system," the clear indications that the claimed invention was intended to address deficiencies in legacy pager systems, and the repeated references to the claimed communications devices (the "nodes") as "pager units," the Court concludes that the specification supports construing the term "node" as referring to a "pager with two-way communications capability."

c) Prosecution History

Defendants' proposed construction is also supported by the prosecution history. During prosecution, the inventor referred to the invention as a pager and contrasted it to a cellular phone. Specifically, in describing the "[f]eatures" of the invention, the inventor stated: "Compact[-] The size of a *pager* can be made smaller than [a] cellular phone due to its simplify[ied] design in both the electronics and the size of the power supply needed." ECF No. 72-10 at GPNECorp. 00000323 (emphasis added) (disclosure dated Jan. 30, 2004). This statement adds further support to the conclusion that the claimed "node" is a type of "pager."

2. Extrinsic Evidence

a) Dr. Dinan's Testimony

The conclusion that the invention is a type of pager device, albeit an enhanced one, is also supported by the testimony of GPNE's expert, Dr. Esmael Dinan. Dr. Dinan described the claimed invention as an "enhanced pager" and a "pager-type apparatus enhanced . . . ." *See* Green Decl., Ex. 5 ("Dinan Dep.") at 125:12, 125:25-126:2, 132:22-133:3. Dr. Dinan contrasted this device to "legacy pagers." *Id.* at 125:20. According to Dr. Dinan, the difference between the device claimed in the patent and legacy pagers is that the claimed device is "enhanced with preprogrammed software and appropriate hardware to allow for two-way data packet communications through a central control station." *Id.* at 125:9-15. (stating that "a POSA [would] understand[] that the

specification discloses a new device that is not merely a pager as in 1993/1994, but a pager-type apparatus enhanced with preprogrammed software and appropriate hardware to allow for two-way data packet communications").

Significantly, Dr. Dinan stated that the term "pager" generally referred to something different than a "telephone." *See id.* at 130:12-17 (agreeing that "in the 1993, 1994 time frame, persons of ordinary skill did not refer to mobile telephones as pagers" or vice versa). Dr. Dinan stated that "1993/1994 era pager[s]" differed from "mobile phone[s] from that same time" in that the pagers "lack[ed] a microphone, a speaker, a processor for processing telephone signals and transmitting those signals, and also potentially a keypad for dialing phone numbers." *Id.* at 127:18-25. Dr. Dinan acknowledged that GPNE's enhanced pager device, as described in the specification, similarly lacks the components necessary to qualify as a telephone. *See id.* at 129:14-130:11 (stating that "the patent specification's description of the pager devices" does not disclose "circuitry . . . for processing or transmitting telephone signals" or the "programming to support" the processing of telephone signals).

While Dr. Dinan stated that his definition of "enhanced pager" (a phrase which he "coined") was broad enough to include a piece of prior art, "the Bhagat reference," with the ability to communicate on both "pager networks and mobile phone[] networks," *id.* at 133:10-14, Dr. Dinan agreed that, at least in the Bhagat device, separate and distinct electronic componentry was used for communicating on the pager network as compared to the telephone network. *See id.* at 133:22-134:10. Dr. Dinan further acknowledged that the device claimed in the Patents did not include the componentry necessary for "communicating with a telephone network." *Id.* at 134:11-19.

Thus, the Court finds that Dr. Dinan's testimony supports the conclusion that the "node" claimed in the Patents is a type of pager, albeit an enhanced one. Dr. Dinan's testimony also supports the conclusion that the term "pager" connotes a type of device that has characteristics or qualities that distinguish it from other devices such as telephones. Thus, Dr. Dinan's testimony supports construing "node" as referring to a "pager," albeit one that has been "enhanced with preprogrammed software and appropriate hardware to allow for two-way data packet

communications," and not simply as referring to a device in a network. *Id.* at 125:9-15.

b) Dictionary Definitions

GPNE argues that its construction of "node" as a "device in a network that can transmit and receive information" is supported by dictionary definitions of "node" and "pager." The Microsoft Computer Dictionary provides that, "[i]n networking," a "node" is "a device . . . that is connected to the network and is capable of communicating with other network devices." Declaration of Steven W. Hartsell in Support of GPNE's Opening Brief on Claim Construction ("Hartsell Decl."), Ex. D, ECF No. 69-5 (Microsoft Computer Dictionary (2002)). The McGraw-Hill Dictionary of Scientific Terms, defines "pager" as "[a] receiver in a radio paging system." *See* Hartsell Decl., Ex. J, ECF No. 69-11 (McGraw-Hill Dictionary of Scientific and Technical Terms (6th ed. 2002)). GPNE argues that because a "pager" only receives radio communications and GPNE's device both receives and transmits, GPNE's device is not a pager. The Court does not find GPNE's proffered dictionary definitions persuasive.

As set forth above, the specification, prosecution history, and GPNE's expert, Dr. Dinan's, testimony, confirm that the "node" is a type of pager and that accordingly, the term does not refer to any "device . . . that is connected to the network and is capable of communicating with other network devices." Hartsell Decl, Ex. D. Furthermore, while legacy pagers might only have been capable of "receiv[ing]" communications in "a radio paging system," *id.*, Ex. J, the Court is not persuaded that the addition of transmitting functionality robs the device of its fundamental nature as a pager. Rather, the additional functionality supports the conclusion that the node is a pager with "enhanced" functionality. *See* Dinan Dep. at 125:9-15 (describing device as an "enhanced" pager type apparatus).

3. Conclusions Regarding the "Device" Versus "Pager" Dispute

As set forth above, while the claims do not define the "node" as a "pager," the specification, prosecution history, and the testimony of GPNE's expert, Dr. Dinan, all support the conclusion that the node is a type of pager with two-way data communications capability. Significantly, the term "pager" implies a particular type of device, which may have different qualities than other devices such as telephones. *See* '267 Patent at 14:14-15 (stating that the

claimed "two-way paging system [would] operate[] independently from [the] telephone system"); Dinan Dep. at 127:16-25; 129:15-130:17. Accordingly, it is appropriate that the construction of node disclose that it is a type of pager and not merely a device in a network. The Court therefore construes "node" as meaning a "pager with two-way data communications capability."

B. "operat[e] independently of a telephone network"

Having determined that the "node" is a type of "pager," the question remains whether the Court should adopt Defendants' language stating that the pager "operat[es] independently of a telephone network." *See* Opening Br. at 3. Defendants contend that this language correctly limits the definition of "node" to devices which cannot operate on the telephone network. While GPNE does not appear to dispute that the device must have the capability of operating independently of the telephone network, GPNE does not agree that the device cannot also have the capability of operating on a telephone network. *See id.* at 5. As will be set forth below, the Court finds that the claim language, specification, and the testimony of Dr. Dinan support the conclusion that, while the "node" must be capable of transmitting data on a "paging system" that is independent of the telephone network, the "node" is not precluded from also having the capability of operating on the telephone network.

1. Claim Language/Specification

The claim language does not explicitly disclose any requirement that the "node" "operat[e] independently of a telephone network." Defendants argue that the Court should nevertheless include such a limitation based on language appearing in the specification. *See* Resp. Br. at 4-5. Specifically, Defendants cite the portion of the specification providing that "the invention provides a two-way paging system which operates independently from a telephone system for wireless data communication between users." '267 Patent at 14:14-16. Defendants appear to contend that this statement supports the conclusion that the node may only communicate on a pager network and therefore cannot be a device capable of communicating on the telephone network. *See* Resp. Br. at 5 ("And consistent with pagers of its time, the pager of the Patents-in-Suit communicates on a paging network, not a telephone network.") (citing '267 Patent at 14:14-16). In contrast, GPNE contends that this statement supports only the proposition that the "two-way paging"

communications must occur independently of the telephone network, and does not support the conclusion that the node itself cannot also be connected to and thus capable of communicating on the telephone network. Opening Br. at 5. The Court agrees with GPNE.

As an initial matter, the cited statement from the specification refers to the "two-way paging *system*" and not specifically to the "pager unit." '267 Patent at 14:14-16 (emphasis added). It is not clear whether "paging system" refers to the overall communications system or whether "paging system" refers to individual "pager units." A paging *system* may exist and operate independently of the telephone network without requiring that individual paging *units* operate entirely exclusively from the telephone network. A pager unit could, for example, transmit certain data communications on a paging *system* that "operates independently from [the] telephone system," while engaging in other types of communications on the telephone system. '267 Patent at 14:14-16.[6] Accordingly, the Court cannot infer from the above statement in the specification that the inventor intended to limit the claimed "node" to devices that communicate exclusively on the pager system. Thus, the specification does not support Defendants' construction.

2. Prosecution History

The statements of the inventors, Gabriel Wong and Po Sing Tsui, to the Patent Office also undermine Defendants' proposed construction. In one disclosure, they state:

> The paging system used in the paging industry of today is a passive device in which a pager could only be paged and cannot return a page call without accessing the telephone system.
>
> This disclosure depicts the design of a two-way paging system which operates independently from the telephone system for a wireless data communication between the users.

See Hartsell Decl., Ex. F, ECF No. 69-7 at GPNECorp. 00000314.

When viewed in this context, it appears that the phrase "which operates independently from the telephone system" is meant only to indicate that the system can return a "data communication"

[6] Indeed, the Court notes that, while it is clear from the "operating independently" statement that the paging system must transmit data independently of the telephone system, other parts of the specification suggest that the paging system may still have the capability to interact with the telephone system. *See* '267 Patent, Figs. 1 and 7 (describing central control office which may receive information from "computerized telephone answering system"); *id.* at 3:1-3 (stating that "central control station **20** includes central computer **30**; transmitter **32**; receiver **34**; and computerized telephone answering system").

or a "page call" without "accessing the telephone system," and does not necessarily mean that the system and/or individual pager units cannot have any interaction with the telephone system. *Id.*; *see also id.* at GPNECorp. 00000323 (stating that one feature of the system is its ability to "operate independently from the existing telephone system to return a page call").

3. Dr. Dinan Testimony

Defendants argue that their proposed construction is supported by Dr. Dinan's testimony. The Court disagrees. Dr. Dinan's testimony establishes that pager networks and telephone networks are distinct and that the electronic componentry and programming that permits a device to communicate on each is generally different. *See* Dinan Dep. at 133:10-134:10. However, Dr. Dinan stated that an "enhanced pager," as he defined the term, would include devices with the componentry to communicate on both networks. *See id.* at 133:10-14. Accordingly, Dr. Dinan's testimony does not support the proposition that the claimed devices *must* operate exclusively on pager networks and cannot also include the capability to operate on telephone networks.

4. Conclusions Regarding the Operate Independently of a Telephone Network Limitation

For the reasons set forth above, the Court rejects Defendants' proposed construction to the extent Defendants seek to limit the "node" to devices which do not have the capability of operating on a telephone network. However, because the specification clearly discloses that the "paging system . . . operates independently from a telephone system for wireless data communication between users," '267 Patent at 14:14-16, and thus implies that the "node" must have the capability to communicate on a paging system that is independent of the telephone system, the Court includes the following language in the construction of "node": "that transmits wireless data communications on a paging system that operates independently from a telephone network." The Court advises the parties that this construction should not be read as implying that the node cannot also send "data communications" on a telephone system if the telephone system permits such communications.

5. The Final Construction of "Node"

For the reasons set forth above, the Court construes "node" as "pager with two-way data communications capability that transmits wireless data communications on a paging system that

operates independently from a telephone network."[7]

C. "frequency"

While the parties initially disputed the construction of this term, at the June 6, 2013 *Markman* hearing, the parties agreed to the following construction for frequency, which the Court adopts: "a number expressed in hertz."

D. "randomly generated information"

Terms in Dispute	GPNE's Proposed Construction	Defendants' Proposed Construction
"randomly generated information"	No construction necessary, or "Information that is randomly generated"	"Identification of the randomly selected time slot"

The term "randomly generated information" appears in all three Patents. For example, the '267 Patent discloses:

> **13.** The first node of claim **12**,
>
> wherein the random access request signal transmitted from the first node includes **randomly generated information** created by the first node,
>
> wherein the first grant returns said **randomly generated information** to the first node to enable identification of the first node as a desired recipient of the first grant.

Id. at 16:1-7 (emphasis added); *see also* '492 Patent at 21:8-38 (claiming a node "wherein the first grant signal returns randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal"); '954 Patent at 17:37-40 ("The first node of claim **18**, wherein the interface is further controlled by the processor to: transmit randomly generated information created by the first node . . . ."). Defendants request construction of this term to clarify the meanings of Claims 13, 31, and 39 of the '267 Patent, Claim 37 of the '492 Patent, and Claims 19 and 22 of the '954 Patent. *See* Resp. Br. at 26.[8]

[7] In the remainder of this Order, the Court for simplicity may uses the term "device" or "node" to refer to the node. This use is not meant to indicate that the node may be any device and need not be a type of pager.

[8] Plaintiffs do not specify whether the constructions they request in their Claim Construction brief apply to all the Patents or all the claims. Defendants include in parentheses in the headings of several of their requested constructions the identity of certain claims. *See, e.g.*, Resp. Br. at 26 ("I. 'randomly generated information' ('492 Pat. claim 37, '267 Pat. claims 13, 31, 39, and '954 Pat.

The parties dispute whether the term "randomly generated information," a term which appears in all three Patents, refers generically to "[i]nformation that is randomly generated," as proposed by GPNE, or whether the term refers more specifically to the "[i]dentification of the randomly selected time slot," as proposed by Defendants. GPNE argues that no construction is needed and that if a construction is required, the term should be construed as "information which is randomly generated." Opening Br. at 11-12. Each party cites the claim language and specification in support of its proposed interpretation. The Court agrees with GPNE that "randomly generated information" means "[i]nformation that is randomly generated."

1. Claim Language

As an initial matter, the Court finds that the claim language supports GPNE's proposed construction. The claim language indicates that the "node" generates certain random information which is "transmitted" and then returned to the node by the control station as part of the "first grant," so that the node is able to identify that it, and not some other node, is the "desired recipient of the first grant signal. *See, e.g.*, '267 Patent at 16:1-7. The claim language does not state that the "randomly generated information" must be the identity "of the randomly selected time slot." Thus, the claim language supports GPNE's construction, wherein the term simply refers to "[i]nformation that is randomly generated."

2. Specification

The specification also fails to persuade the Court that Defendants' more narrow interpretation -- wherein "randomly generated information" refers to "[i]dentification of the randomly selected time slot" -- should be adopted. The terms "random" or "randomly" appear almost exclusively in the portion of the specification describing the "Operation of [the] Second Embodiment." '267 Patent at 11:4.[9] In the second embodiment, when a "pager unit" enters a new

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claims 19, 22)"). Notably, neither party has clearly argued that the constructions for this term or any other term should be different for different Patents or claims.

[9] The term "random" also appears in the Abstract of the '267 Patent. Specifically, the Abstract refers to the "random access request signal." *See e.g.* '267 Patent, Abstract ("When a first node has data to transmit, the first node transmits a random access request signal."). The claim language distinguishes the "random access request signal" and the "randomly generated information." *See e.g. id.* at 16:2-4 ("The first node of claim 12, wherein the random access request signal transmitted from the first node includes randomly generated information created by the first node . . . .") .

region controlled by a different central control station, the pager unit must "execute[] a channel switching routine." *Id.* at 11:19-21. As part of this routine, when the pager unit discovers that it has entered a new area, "the request on frequency C_4 is randomly made." *Id.* at 11:47-49. By "randomly made," the specification appears to mean that the request is made in a "time slot which [the] pager unit . . . randomly generate[s]." *Id.* at 11:58-59; *see also id.* at 11:46-51. After the pager unit makes its request in the randomly generated time slot, the pager unit monitors communications from the control station until it detects a message from the station "that includes . . . information stored in the same [randomly generated] time slot [in] which" the pager unit transmitted its request. *Id.* at 11:52-59.

Thus, in the second embodiment, the "randomly generated information" is the time slot upon which a pager transmits its first request to a new control station. Defendants argue that the specification's use of the term random therefore supports Defendants' construction wherein the "randomly generated information" refers to the "identification of the randomly selected time slot." Resp. Br. at 26. Defendants also note a statement in the portion of the specification setting forth the second embodiment describing the random time slot as "the only way [the] central control station . . . can identify the in-wandering pager unit." *Id.* at 15; *see also* '267 Patent at 13:1-3 ("At this point, such time slot is the only way central control station **420** can identify the in-wandering pager unit **422**.").

While the Court agrees that the description of the second embodiment supports Defendant's construction, this does not provide a sufficient basis to adopt Defendants' proposed construction. It is well established that "particular embodiments appearing in the written description will not be used to limit claim language that has broader effect." *Innova/Pure Water, Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1117 (Fed. Cir. 2004) (citing *Electro Sci. Indus., Inc. v. Dynamic Details, Inc.*, 307 F.3d 1343, 1349 (Fed. Cir. 2002); *Laitram Corp. v. NEC Corp.*, 163 F.3d 1342, 1347-48 (Fed. Cir. 1998)). Thus, "even where a patent describes only a single embodiment, claims will not be 'read restrictively unless the patentee has demonstrated a clear

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Accordingly, the references to the "random access request signal" in the Abstract are not helpful in determining the meaning of the term "randomly generated information."

intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction.'" *Id.* (quoting *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir. 2004) (citation omitted)).

Here, the claim language broadly refers to "randomly generated information." '267 Patent at 16:3. While the randomly generated information in the second embodiment is the identification of the randomly generated time slot, the specification does not express a "clear intention to limit the" broad language used in the claims -- "randomly generated information" -- to the identification of the randomly generated time slot. *Innova/Pure Water, Inc.*, 381 F.3d at 1117.

In Defendants' Claim Construction Brief, Defendants rely heavily upon a statement in the portion of the specification discussing the second embodiment wherein the time slot is described as the "only way [the] central control station . . . can identify the in-wandering pager unit." '267 Patent at 13:1-3; Resp. Br. at 15. Again, this statement appears in the context of describing a preferred embodiment and the only clear inference that can be drawn from this statement is that, in the second embodiment, the random time slot is the means by which the central control station identifies the incoming pager. The Court cannot discern from the cited language a clear intent to limit the randomly generated information in all embodiments to the randomly generated time slot. Accordingly, Defendants' reliance on the "only way" statement is misplaced. *See Innova/Pure Water, Inc.*, 381 F.3d at 1117 (providing that limitations will not be inferred from embodiments "unless the patentee . . . demonstrate[s] a clear intention to limit the claim scope").

The Court therefore concludes that the specification does not support Defendants' construction wherein the "randomly generated information" refers to the "[i]dentification of the randomly selected time slot." Resp. Br. at 26.

3. Defendants' Remaining Arguments

Defendants raise three additional arguments in support of their construction. For the reasons set forth below, each of these arguments fails.

First, Defendants argue that GPNE's construction, wherein the "randomly generated information" may be any randomly generated information, should not be adopted because "it would encompass matter beyond what the specification conveys is the alleged invention." Resp.

Br. at 27. Defendants rely upon *Retractable Technologies, Inc. v. Becton, Dickinson & Co.*, wherein the Federal Circuit held that, notwithstanding the fact that "the claims [left] open the possibility that the recited 'body' [might] encompass a syringe body composed of more than one piece," the specifications for the patents warranted limiting the claim scope to "one-piece bod[ies]." *Id.*, 653 F.3d 1296, 1305 (Fed. Cir. 2011). *Retractable* is distinguishable. In that case, not only were the embodiments "expressly limited to having a body that is a single piece," unlike in the present case, the specifications "expressly recite[d] that 'the *invention*'" included this limitation. *Id.* (emphasis added); *see also SciMed Life Sys.*, 242 F.3d at 1343 ("[T]he characterization of the coaxial configuration as part of the 'present invention' is strong evidence that the claims should not be read to encompass the opposite structure."). Accordingly, Defendants' reliance on *Retractable* is misplaced.[10]

Second, Defendants argue, in conclusory fashion, that construing the term "randomly generated information" to include any randomly generated information would render the claims "invalid . . . for lack of written description." Resp. Br. at 27. The Court is not persuaded. 35 U.S.C. § 112(a) provides that a patent must include, separate from and in addition to the claims, "a written description of the invention." "The test for sufficiency of the written description… [is] 'whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.'" *In re Owens*, 710 F.3d 1362, 1366 (Fed. Cir. 2013) (internal citation omitted). Whether a written description is sufficient is a "question of fact," *id.*, and is therefore "generally not a proper part of claim construction," *GeoTag, Inc. v. Frontier Commcns Corp.*, No. 2:10-CV-265-JRG, 2013 WL 693852, at *24 (E.D. Tex. Feb. 26, 2013) (citations omitted).

Here, it is possible that the Patents will, at a later stage, be deemed invalid for lack of a sufficient written description to the extent the specification fails to describe randomly generated

[10] Defendants also contend that GPNE's construction of "randomly generated information" -- "information that is randomly generated" -- must be rejected because it is "circular" and "unhelpful." Resp. Br. at 27 (citing *Power-One, Inc. v. Artesyn Technologies, Inc.*, 599 F.3d 1343, 1348 (Fed. Cir. 2010)). The Court is not persuaded. The claim term -- "randomly generated information" -- is relatively simple to understand. GPNE's construction will adequately "ensure that the jury fully understands . . . what the patentee covered by the claims." *Power-One, Inc.*, 599 F.3d at 1348 (citation omitted).

information other than the random time slot. *See In re Owens*, 710 F.3d at 1366 (holding that written description must show that "the inventor had possession of the claimed" invention). Nevertheless, as set forth above, under the ordinary rules of claim construction, it would not be proper for the Court to limit the term "randomly generated information" based solely on the preferred embodiment in the specification. Where the ordinary rules of claim construction support a broad construction of a term, the Court may not adopt a narrower interpretation to prevent the claims from being deemed invalid for lack of an adequate written description. *See Liebel-Flarsheim Co.*, 358 F.3d at 913, 914 (construing "physical indicia" broadly because the claim language did not limit the term to indicia related to the length of the extender and it would be improper to limit the scope of the invention based on the embodiment, and rejecting defendant's argument that the claim term should be interpreted narrowly to avoid having claim declared "invalid for lack of a written description or enablement"); *id.* at 911 ("[T]he court has 'admonished against judicial rewriting of claims to preserve validity'." (internal citation omitted)).

Finally, Defendants argue that if the Court adopts GPNE's proposed construction, the Patents will fail for lack of enablement. Resp. Br. at 27. The enablement requirement "requires that the specification teach those in the art to make and use the invention without 'undue experimentation.'" *In re Vaeck*, 947 F.2d 488, 495 (Fed. Cir. 1991) (internal citation omitted). "That *some* experimentation may be required is not fatal; the issue is whether the amount of experimentation required is 'undue.'" *Id.* (internal citation omitted). Here, Defendants have cited no evidence supporting the proposition that it would require "undue experimentation" for a POSA to create a node wherein the randomly generated information sent and received by the first node is something other than the randomly generated time slot. *Id.* Accordingly, Defendants' enablement argument fails.

Thus, for the reasons set forth above, the Court construes "randomly generated information" as "information that is randomly generated."

E. "count value"

GPNE Proposed Construction	Defendants' Proposed Construction
"A numeric representation of the amount of	"The number of consecutively related packets

remaining data to be transmitted"	emanating from a transmitter"

The terms "count value" appear in all three Patents. For example, the '267 Patent states:

> 12. The first node of claim 11, wherein the total number of related packets being transmitted comprises a **count value** to enable a receiving node in the plurality of nodes to determine when the first data packets being transmitted together are completely received.

Id. at 15:63-67 (emphasis added). Defendants request this construction in connection with Claims 12 and 30 of the '267 Patent, Claim 37 of the '492 Patent, and Claim 18 of the '954 Patent.

Both parties agree that a count value is a number used to determine when the last data packet in a transmission has been received. *See* Opening Br. at 13; Resp. Br. at 25. The parties dispute, however, the precise nature of the count value. *Id*. GPNE contends that the specification discloses a means of using a dynamic countdown metric in which each data packet carries a unique count value, *i.e.* that the count value is an incrementally changing number such as 1 of 10, 2 of 10, etc. *See* Opening Br. at 13-14. Defendants, however, argue that this system is not supported by any language in the specification and that the count value is a static number which reflects the "number of consecutively related packets emanating from a transmitter." *See* Resp. Br. at 25-26. For example, under Defendants' proposed construction, each packet in a message consisting of 10 packets would disclose that the count value is 10. *Id.* As discussed below, the Court agrees with Defendants that GPNE's proposed construction is not supported by the claim language or specification. Therefore, the Court construes "count value" as "the number of consecutively related packets emanating from a transmitter."

1. Claim Language/Specification

At the outset, the Court finds that the claim language is most consistent with Defendants' proposed construction wherein count value refers to the total number of related packets. Significantly, several claims in the '267 Patent and one claim in the '954 Patent define the "count value" as the "total number of related packets being transmitted . . . to enable a receiving node in the plurality of nodes to determine when the first data packets being transmitted together are completely received." '267 Patent at 18:14-19 (Claim 30); *see also* '954 Patent at 17:32-36; Transcript of June 6, 2013 Claim Construction Hearing ("Tr.") at 139:6-8. *See generally Phillips*, 415 F.3d at 1313 (noting that the words of the claim themselves are the objective starting point for

claim interpretation).[11]

Turning to the specification, both sides cite the following statement in the specification as supporting their respective constructions: "the packets may be formatted in a manner to indicate the number of consecutively related packets emanating from a transmitter (e.g., there may be a separate packet field indicating the continuation number of related packets)." *See* '267 Patent at 5:26-30; Opening Br. at 14; Resp. Br. at 25. While this statement is somewhat ambiguous, the reference to "number of consecutively related packets" suggests that the count value is, as Defendants contend, a static value representing the total number of packets in a message.[12]

GPNE argues that part of the aforementioned statement supports the conclusion that the count value is a changing number representing the amount of remaining data because the statement refers to a "continuation number" and there is language in the specification describing "the separate packets making up a message . . . as 'continuations'." Opening Br. at 14; *see also* '267 Patent at 7:55-56 ("[S]ubsequent communication packets providing continuations of the message content."). The Court is not persuaded. Even if "continuations" are "separate packets," Opening Br. at 14, it does not necessarily follow that the "continuation number of related packets," '267 Patent at 5:29-30, must be a dynamic, changing number representing the amount of remaining data to be transmitted. The "continuation number of related packets" may still refer to a single number representing the total number of "separate packets" in a transmission.

Finally, at the June 6, 2013 *Markman* hearing, GPNE claimed for the first time that its construction is supported by Figure 5. Tr. at 136:17-139:5. Figure 5 consists of a flow chart describing how the pager processes incoming data packets and commands from the control station. One step in the process of receiving packets is labeled "end of message" and directs the pager to

[11] The claim language in the '492 Patent does not define count value, besides stating that it is used by the node in determining when all packets have been received. *See* '492 Patent at 17:35-38 (stating that the "count value . . . enables the processor of the controller to determine when the data packets being transmitted are completely received"). As will be discussed *infra* in addressing GPNE's arguments regarding Figure 5 of the specification, the Court is not persuaded that the count value must be a dynamic, changing number simply because it is used in determining when all packets have been received.

[12] Notably, GPNE does not appear to dispute the fact that the first portion of the quoted statement refers to a static value representing the total number of packets. *See* Opening Br. at 13 ("Defendants' construction appears to address the total number of packets - a static number ('the number of consecutively related packets emanating from a transmitter').").

proceed along different paths based on whether the answer to this inquiry is "yes" or "no." *See* '267 Patent, Fig. 5; *id.* at 7:56-57 ("[M]icroprocessor **80** checks at step **316** to ensure that the entire message has been received."). Figure 5 does not indicate how the pager determines whether the packet is the "end of message," but GPNE argues that the pager could only make this determination if the count value is, as GPNE contends, a dynamic, changing number representing the amount of remaining data which reaches zero on the last packet. *See* Tr. at 138:14-24. The Court disagrees. Even if the count value is a static number representing the total number of packets, the pager could still determine that the last packet is the end of the message. For example, if a message has a count value of 10, and the pager is aware that it has previously received 9 packets, then the pager could determine that the tenth packet is the last packet. Accordingly, Figure 5 does not provide a basis to conclude that the count value is, as GPNE contends, a dynamic, changing number representing the amount of data remaining in a message.

Thus, for the reasons set forth above, the Court finds that Defendants' description of "count value" as "[t]he number of consecutively related packets emanating from a transmitter" is the most consistent with the specification.

2. **Extrinsic Evidence**

GPNE also argues that its proposed construction is supported by the testimony of Dr. Dinan. *See* Opening Br. at 14; Resp. Br. at 25. Dr. Dinan's testimony does not persuade the Court that GPNE's construction should be adopted.

Dr. Dinan opined that the count value represented a dynamic number, which is assigned to each packet and indicates the packet's place in the sequence of packets constituting a message. *See* Hartsell Decl., Ex. E ("Dinan Decl."), ¶¶ 65, 70-71; Dinan Dep. at 170:16-171:4. Dr. Dinan relies in part on the portions of the specification discussed above, particularly the references to the "continuation number." *See* Dinan Decl. ¶¶ 61-64. The Court disagrees with Dr. Dinan's opinion that the specification supports Plaintiff's construction for the reasons set forth above.

Dr. Dinan also relies on certain statements in the prosecution history. Specifically, Dr. Dinan relies on an exchange between GPNE and the examiner relating to Claim 69 of the '492 Patent. *See* Dinan Decl. ¶ 67. As drafted in November 2009, Claim 69 provided "wherein the

interface further transmits information relating to a **count value**, and wherein the interface further transmits terminal indication information indicating that the final data packet is the last data packet." *See* Dinan Decl. ¶ 66.[13] In a November 2009 office action, the examiner rejected this claim. The examiner acknowledged that the prior art, Patent No. US005677909A ("Heide"), did not specifically disclose the use of a "count value" and disclosed only the use of a "'more' bit" to indicate the last packet in a data transmission. *See* Dinan Decl. ¶ 67 (quoting November 27, 2009 office action). However, the examiner stated, "[i]t would have been obvious to one of ordinary skill in the art," that Heidi "was made to have **a counting down system in order to be aware [of] the total number [of] packets that need to be received.**" *Id.* (quoting November 27, 2009 office action). In March 2010, GPNE responded that its device did not feature the "'more' bit" termination character. *See id.* ¶ 68 (quoting March 2010 response). GPNE did not correct the examiner's description of the "count value" as "a counting down system." Dr. Dinan argues that GPNE's failure to correct the examiner's statement indicates that the inventors believe the count value was a counting down system. *See id.* ¶ 69.

The Court is not persuaded that GPNE's failure to correct the examiner's statements necessarily means that the "count value" was, and always has been, intended to refer to a counting down system. Given that the specification describes the "count value" as a static number and does not describe a counting down system, the Court declines to conclude that count value refers to a dynamic number based on this ambiguous exchange in the prosecution history.

Accordingly, for the reasons set forth above, Dr. Dinan's testimony does not persuade the Court that GPNE's construction of "count value" should be adopted. Thus, in light of the statements in the specification, the Court adopts Defendants' construction wherein "count value" is "[t]he number of consecutively related packets emanating from a transmitter."

[13] GPNE did not provide this portion of the prosecution history (or at least did not identify it in their filings). Defendants provided the Court with a DVD containing copies of the entire prosecution history for each of the three Patents. Because Defendants did not file the DVD, the Court cites Dr. Dinan's declaration for the relevant quotations. The Court has checked Dr. Dinan's declaration against the prosecution history contained on Defendants' DVD to ensure the accuracy of Dr. Dinan's quotations.

F. "interface [configured/controlled] by the at least one processor to [transmit and receive terms]"

Terms in Dispute	GPNE's Proposed Construction	Defendants' Proposed Construction
"interface [configured / controlled] by the at least one processor to [transmit and receive terms]"	"Electronic circuitry capable of being configured / controlled by the processor(s) according to instructions in the memory, that allows the processor(s) to communicate with a transceiver"	"Electrical connections (e.g., wires or interconnect) that allow signals to pass between the processor and a transceiver (i.e., transmitter / receiver components). The functional language purportedly describing how the interface is controlled or configured imparts no structure to the interface and, therefore, is entitled to no patentable weight in distinguishing the prior art. Alternatively, if accorded patentable weight, this functional language renders the claims indefinite as hybrid apparatus / method claims."

The term "interface [configured/controlled] by the at least one processor to [transmit and receive terms]" ("Interface") appears in a number of claims in the three Patents.[14] For example, the '267 Patent discloses:

> 1. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:
>
> at least one processor;
>
> a memory providing code to the least one processor; and
>
> an **interface controlled by the least one processor to:**
>
> **transmit** a random access request signal . . .;
>
> **receive** a first grant signal . . .;
>
> **transmit** the reserve access request signal in the second slot in response to the first grant signal;
>
> **receive** a second grant signal . . .; and
>
> **transmit** the first data packets in response to the second grant signal . . .

See id. at 14:60-15:21 (emphasis added).

The parties generally agree that the Interface is electrical connections or circuitry enabling signals to pass between the processor and the transceiver. However, the parties dispute whether the

[14] The claims of the '267 and '954 Patents recite that the Interface is "controlled by" the processor. The claims of the '492 Patent recite that the Interface is "configured by" the processor.

construction of Interface should state that the electronic circuitry/connections are "capable of being configured/controlled by the processor(s) according to instructions in the memory." Opening Br. at 15. Defendants also argue that the construction of Interface should disclose that the term is either not entitled to "patentable weight" or, alternatively, is indefinite. Resp. Br. at 18. The Court does not agree that the construction of the term (which would theoretically be provided to the jury) should state that the term lacks patentable weight and/or is indefinite. Nevertheless, the Court will consider Defendants' arguments regarding patentable weight and indefiniteness after considering the parties' arguments regarding GPNE's proposal to include the "according to instructions in the memory" language in the construction of Interface.

1. "instructions in the memory"

As set forth above, GPNE argues that the Interface must be "capable of being configured/controlled by the processor(s) according to instructions in the memory." *See* Opening Br. at 14. In Defendants' claim construction brief, Defendants appeared to contest the inclusion of this language. However, at the June 6, 2013 *Markman* hearing, Defendants agreed that the Interface must be "capable of being configured/controlled by the processor(s) according to instructions in the memory" and indicated that Defendants did not object to the inclusion of this language in the construction of Interface. Tr. at 121:3-17**.** Accordingly, the Court finds that the construction for interface should include the phrase: "which is configured/controlled by the processor(s) according to instructions in the memory."[15]

2. Patentable Weight

Having adopted GPNE's configuration/control language, the Court proceeds to consider the issue of patentable weight. Defendants argue that the language requiring that the Interface be able to be "configured/controlled . . . to[] transmit . . . [and] receive" information is functional in that it attempts to define the structure of the invention by its function. *See* '267 Patent at 14:60-15:21. Defendants argue that this "functional language" does not, however, actually "impart[] [any

[15] The Court recognizes that GPNE's proposed construction used the language "Electronic circuitry *capable* of being configured/controlled by the processor(s) according to instructions in the memory." As will be discussed *infra* in Section III.G.3, the inclusion of the term "capable" introduces ambiguity as to whether the device must be actually configured or programmed to perform the relevant functions.

unique] structure to the interface" and, therefore, is entitled to no patentable weight in distinguishing the prior art. Resp. Br. at 18. As will be set forth below, the Court finds that the issue of patentable weight is not appropriately resolved at this juncture.

The concept of patentable weight is explained in *In re Schreiber*, 128 F.3d 1473 (Fed. Cir. 1997). In that case, the Federal Circuit considered whether a prior art reference disclosing a conical shape "useful for purposes such as dispensing oil from an oil can" anticipated the plaintiff's claim for a conical device useful for dispensing popcorn. *Id.* at 1474-77. The plaintiff argued that his conical structure was not anticipated because the prior art reference did not disclose that the oil dispensing device claimed was also useful for dispensing popcorn. *Id.* at 1477. The *Schreiber* Court disagreed, reasoning "the recitation of a new intended use for an old product does not make a claim to that old product patentable." *Id.* Accordingly, the *Schreiber* Court held that the plaintiff's "contention that his structure [would] be used to dispense popcorn [did] not have patentable weight [because] the structure [was] already known, regardless of whether it has ever been used in any way in connection with popcorn." *Id.* Thus, *Schreiber* supports the proposition that language defining a structure by its function is not entitled to patentable weight if it does not require that the structure have qualities and capabilities that distinguish it from the prior art.

In this case, the Court rejects Defendants' patentable weight argument because it does not appear to be an issue of claim construction, and thus, is not properly decided at this stage. Significantly, the holding in *Schreiber* was issued in the context of deciding an appeal of the United States Patent and Trademark Office's rejection of the *Schreiber* plaintiff's patent claims on the grounds that the claimed invention was anticipated by the prior art. As noted by the district court in *Freeman v. Gerber Products Co.*, the patentable weight issues raised in *Schreiber* related to "[p]atentability . . . rather [than] the issue . . . [of] claim construction." *Id.*, 357 F. Supp. 2d 1290, 1297 n.2 (D. Kan. 2005). Accordingly, the Court is not persuaded that this issue is properly raised at this stage and rejects Defendants' argument on this ground. *Id.* (finding "*In re Schreiber* to be inapposite, at least at this procedural juncture [claim construction]"). *But see Collegenet, Inc. v. ApplyYourself, Inc.*, No. CV-02-484-HU, 2002 WL 34471701, at *18 (D. Or. Dec. 19, 2002) ("[a]ssuming" without deciding "that the determination of the patentable weight" of claim term

was "proper at the claim construction stage" and rejecting "defendant's argument" (citation omitted)).

3. Indefiniteness

Defendants also argue that, if the Court does not determine that the functional language is not entitled to patentable weight, the Court should find that the claims featuring this language are indefinite. Resp. Br. at 18. While Defendants argument regarding indefiniteness is limited, *see id.* at 21 n.15 (discussing indefiniteness), the Court surmises that Defendants are contending that the "functional language renders the claims indefinite as hybrid apparatus / method claims." *Id.* Defendants appear to rely upon *IPXL Holdings, L.L.C. v. Amazon.com, Inc.*, 430 F.3d 1377 (Fed. Cir. 2005). *See id.* at 21 n.15. This case is distinguishable.

In *IPXL*, the Federal Circuit held that a claim directed towards a system for executing electronic financial transactions was indefinite because the claim appeared to simultaneously claim both the system (an apparatus) and a method for using the system (a method claim). *IPXL Holdings, L.L.C.*, 430 F.3d at 1384. The relevant *IPXL* claim, Claim 25, read as follows:

> The *system of claim 2* [including an input means] wherein the predicted transaction information comprises both a transaction type and transaction parameters associated with that transaction type, and *the user uses the input means* to either change the predicted transaction information or accept the displayed transaction type and transaction parameters.

Id. (emphasis added by the *IPXL* Court). The *IPXL* Court recognized that "'[a] claim is considered indefinite if it does not reasonably apprise those skilled in the art of its scope.'" *Id.* at 1383-84 (citation omitted). The *IPXL* Court reasoned that claims that simultaneously claim both an apparatus and a method for using the apparatus may be indefinite because they fail to apprise manufacturers whether infringement occurs when one creates the apparatus or whether infringement occurs when the user actually uses the apparatus. *Id.* at 1384. The *IPXL* Court held that Claim 25 was indefinite because it claimed "both a system" (an apparatus) "and the method for using that system." *Id.* (Claim 25 claiming "[t]he *system of claim 2* . . . wherein the predicted transaction information comprises both a transaction type and transaction parameters . . ., and *the user uses the input means* to" perform certain functions).

IPXL is not apposite here. As recognized by the District Court in *Datamize, LLC v.*

Plumtree Software, the scope of *IPXL* is very narrow. *See id.*, No. C 04-2777 VRW, 2007 WL 5720627, at *12 (N.D. Cal. Aug. 7, 2007) (recognizing that "*IPXL* . . . [stands] for the narrow rule that a single claim 'may not purport to cover a system, independent of any use of the system, and simultaneously purport to cover a particular use of the system'" (quoting *Collaboration Props., Inc. v. Tandberg ASA*, No. C 05-01940 MHP, 2006 WL 1752140, at *7 (N.D. Cal. June 23, 2006))). Here, Defendants argue that the "transmit" and "receive" functional language "renders the claims indefinite as hybrid apparatus / method claims." Resp. Br. at 18; *see also* '267 Patent at 14:60-15:21 (claiming a "node" that is configured to "transmit" and "receive" certain signals). However, the transmit and receive language, unlike the language in *IPXL*, does not claim a use of the node. Rather, this language provides additional information regarding the structure of the "node" by describing the node's functionality. *Compare id. with IPXL*, 430 F.3d at 1384 (claiming a "system" *and* the "user['s] use[] [of] the input means" (emphasis omitted)). The parties agree that inventors are permitted to define the structure of their inventions by reference to its functionality. *See* Opening Br. at 16; Resp. Br. at 19; *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1021 (Fed. Cir. 2006) (holding that the phrase "for inserting said screw" in claim described "a functional limitation that requires that the opening be capable of inserting the screw"). Because the claim language at issue here does not simultaneously cover both an apparatus and a use of that apparatus, Defendants' reliance on *IPXL* is misplaced. *See Datamize*, 2007 WL 5720627, at *11-12 (holding that *IPXL* did not require a finding of indefiniteness where claims claimed a "computer program storage medium" and described the medium by "its function and capacity to store a program that carrie[d]" out a certain process).

4. Conclusions Regarding Interface Term

For the reasons set forth above, the Court construes "interface [configured/controlled] by the least one processor to [transmit and receive terms]" to mean "Electronic circuitry which is configured/controlled by the processor(s) according to instructions in the memory, that allows the processor(s) to communicate with a transceiver." As to the issue of patentable weight, this issue is not properly addressed during claim construction, and the Court therefore rejects this argument at this time. Finally, the Court rejects Defendants' indefiniteness argument.

G. "providing code to"

Terms in Dispute	GPNE's Proposed Construction	Defendants' Proposed Construction
"providing code to"	No construction necessary, or "capable of making instruction available to"	"Which is currently supplying code to"

The term "providing code to" appears in all three Patents. *See* Resp. Br. at 23. For example, the '267 Patent discloses:

> **1.** A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:
>
> at least one processor;
>
> a memory **providing code to** the least one processor; and
>
> an interface controlled by the least one processor to: . . .

See id. at 14:60-65 (emphasis added).

GPNE contends that this term does not need construction. Opening Br. at 17. Alternatively, if the Court determines that the term "providing code to" does need construction, GPNE contends that it should be construed as "capable of making instruction available to." *Id.*. By "capable," GPNE appears to mean that the memory has been programmed with software that provides instructions regarding how to transmit and receive the specific signals referenced in the patents.[16]

Defendants contend that the use of the participle phrase "providing code to" requires that the memory "actual[ly] perform[] . . . [this] function." Resp. Br. at 23. At the June 6, 2013 *Markman* hearing, Defendants explained that, in Defendants' view, it is not sufficient for the device to merely be programmed to or configured to provide code to the processor. Tr. at 111:9-19, 118:9-12. Defendants contend that the "actual performance" standard is only met when the device is actively providing code to the processor. *Id.* at 111:6-7, 117:25-118:3. In other words,

[16] *See* Reply Br. at 16 (responding to Defendants' arguments regarding the "providing code to" and Interface terms and arguing that "a memory 'actually programmed' and thus *capable of* performing the claimed function, is a device *structured* to meet the functional element") (emphasis added by GPNE) (internal citation omitted); *id.* at 12 (stating that patents "disclose a combination of known hardware devices programmed with software to transmit and receive specific signals"); *id.* (referring to "the programmed signal capabilities" as the "guts of the claims").

the device must "be on and operating." *Id.* at 117:25-118:12. The parties explained that this nuance is significant because, even if the memory in a particular device is programmed to provide code to the processor, whether it actually provides code to the processor may depend on factors such as whether the user turns on the device and causes the device to transmit or receive data. *Id.* at 110:22-111:12, 115:3-12. Thus, under Defendants' construction, Defendants would likely not be liable for direct infringement (because Defendants' devices are not shipped in an active state), but only for indirect infringement based on whether the user has activated his device and used it to transmit data. *Id.* at 114:25-115:14, 117:2-6.

Defendants argue that their "actual performance" construction is supported by the "plain language" meaning of "providing" and is in accord with the Federal Circuit's decision in *Typhoon Touch Technologies, Inc. v. Dell, Inc. ("Typhoon II")*, 659 F.3d 1376, 1382 (Fed. Cir. 2011), as well as the testimony of Dr. Dinan. *See* Resp. Br. at 23. GPNE disagrees that *Typhoon II* supports the proposition that the memory must be in an active state of providing code to the processor (as opposed to simply being actually programmed to provide code to the processor) for the claim language to be satisfied. *See, e.g.*, Reply Br. at 15-17.

For the reasons set forth below, the Court agrees with GPNE that it is sufficient that the memory must be "actually programmed" to provide code to the processor. However, because GPNE's use of the word "capable" in its construction does not clearly require that the memory be actually programmed to provide the code, the Court adopts the following construction of "providing code to": "which is actually programmed to provide code to."

1. Claim Language and *Typhoon II*

Neither party cites any intrinsic evidence besides the claim language. Accordingly, the Court's inquiry focuses on this language. The claim language uses the term "providing," which is the present participle form of "provide." A participle is a verb that functions as an adjective. *See Boston Scientific Corp. v. Micrus Corp.*, 556 F. Supp. 2d 1045, 1071-72 (N.D. Cal. 2008). In this case, "providing code to" modifies and describes the memory.

Defendants take the position that, in light of the claim language's use of the participle form, the "providing code to" requirement can only be satisfied if the device is in an active state of

providing code to the processor. *Id.*; *see also* Resp. Br. at 23. Defendants contend that the claim language is not satisfied if the memory is programmed to provide code to the memory but the device is not in active state. Tr. at 111:6-7, 117:25-118:3. Defendants rely chiefly on the Federal Circuit's decision in *Typhoon II* to support their interpretation of "providing code to." *See* Resp. Br. at 23. For reasons that will be set forth below, the Court is not persuaded that *Typhoon II* supports Defendants' interpretation.

a) Summary of the *Typhoon* Decisions

In *Typhoon II*, the Federal Circuit addressed the proper construction of the phrases "operating in conjunction," "processor for executing," and "memory for storing." *Id.*, 659 F.3d at 1380-82. Defendants appear to rely primarily on the portion of *Typhoon II* addressing "operating in conjunction." *See* Resp. Br. at 23 (citing *Typhoon II*, 659 F.3d at 1382). Accordingly, this Court begins its review of the *Typhoon* decisions with this term.

As set forth in the *Typhoon* district court's opinion, the term "operating in conjunction with" appeared in the following contexts: (1) "an application generator **operating in conjunction** with said operating system to generate said data . . . .", and (2) "a runtime utility **operating in conjunction** with said processor to execute said application." *Typhoon Touch Technologies, Inc. v. Dell, Inc. ("Typhoon I")*, No. 6:07 CV 546, 2009 WL 2243126, at *12 (E.D. Tex. July 23, 2009) (emphasis added). Typhoon argued that "operating in conjunction" described only a "characteristic" of the device, such that the claim language would be satisfied so long as the utility/generator was "*designed* to operate with the" processor/operating system even if the utility/generator did not "actually operate" in this way. *Id.* (emphasis added).

The district court rejected this construction, ruling that the phrase "operating in conjunction" was "not satisfied until the run-time utility . . . . or application generator is actually operating." *Id.* at 13. The Federal Circuit affirmed the *Typhoon* district court's ruling. *Typhoon II*, 659 F.3d at 1381-82. However, the Federal Circuit framed the issue and its conclusions in a slightly different fashion than the district court. As explained by the Federal Circuit, Typhoon's proposed construction failed because, under that construction, the "operating in conjunction" condition would be satisfied so long as the utility/generator "*can be* configured to operate in

conjunction" with the operating system/processor. *Id.* (emphasis added). Thus, the Typhoon's construction would include devices that were not actually configured to operate in the fashion described in the claims. *Id.* (stating that Typhoon's construction would apply to utilities/generators regardless of "whether . . . they have been so configured in the device charged with infringement."). Thus, the Federal Circuit held, the district court was correct in "holding that the claims require actual adaptation, by program or configuration." *Id.* at 1382.

In addition to the phrase "operating in conjunction," in *Typhoon II*, the Federal Circuit addressed the district court's constructions of two other similar phrases: (1) "processor for executing," and (2) "memory for storing." *Id.*, 659 F.3d at 1380-81. With respect to the phrase "memory for storing," the *Typhoon II* Court affirmed the district court's holding that this phrase "requir[ed] that the memory is actually programmed or configured to store the data collection application." *Id.* at 1381. Similarly, with respect to "processor for executing," the *Typhoon II* Court rejected Typhoon's argument that "processor for executing," meant only "that the device has the capability of being programmed or configured to execute the . . . application" and affirmed the district court's holding that the term "requir[ed] that 'the recited function . . . be performed'." *Id.* (quoting *Typhoon I*, 2009 WL 2243126, at *7).

b) Application to the Present Case

Applying the *Tyhpoon* decisions to the instant case, the Court finds that *Typhoon* does not support Defendants' proposed construction. As an initial matter, Defendants' reliance on *Typhoon* is misplaced because, in that case, the Court's conclusions regarding the proper construction of each of the terms at issue were not based on the claim language alone, but rather on the extensive evidence drawn from the specification regarding the meaning of each disputed term. *See e.g. Typhoon II*, 659 F.3d at at 1380-81 (analyzing language from the specification regarding the term "memory for storing" and holding that "the specification is the primary source for determining what was invented and what is covered by the claims"); *Typhoon I*, 2009 WL 2243126 at *12 (finding that "operating in conjunction" meant "actually operating" was supported by the portion of "the specification describe[ing] that '[w]hen the computer . . . is turned on, its operating system is loaded automatically in and the run-time process commences'"). Here, Defendants have not cited

any evidence from the specification to support their proposed construction. Even putting this issue aside, the Court is not persuaded that *Typhoon II* supports Defendants' proposed construction.

The Court acknowledges that the *Typhoon* Courts made statements indicating that a device must actually perform a given function. *See Typhoon II*, 659 F.3d at 1381 (affirming district court's holding that the phrase "processor for executing" "requir[ed] that 'the recited function . . . be performed'"); *Typhoon I*, 2009 WL 2243126, at *13 (requiring that the utility/generator be "actually operating"). However, the Court observes that, in *Typhoon*, the chief issue with Typhoon's constructions was that they only required that the device be capable of being configured or programmed to perform a given function, and did not require that the device actually be so configured or programmed. *See Typhoon II*, 659 F.3d at at 1380 (rejecting Typhoon's argument in connection with the phrase "memory for storing" that "it is irrelevant if the function is actually performed by the device, if the device *can be* programmed or configured to perform the function" (emphasis added)); *id.* at 1381 (rejecting Typhoon's argument in connection with the phrase "processor for executing" that the device need not "be a device with a pre-programmed or pre-loaded data collection application"); *id.* at 1381-82 (rejecting Typhoon's argument in connection with the phrase "operating in conjunction with" that "it suffices if the computer-implemented structures can be configured to operate in conjunction with each other, whether or not they have been so configured"). While the *Typhoon* Courts did make statements suggesting an actual performance requirement, it is not clear that the *Typhoon* Courts, particularly the Federal Circuit, meant to imply that the claim language could only be satisfied by a device in an active state and that the claim language would not also be satisfied by a device that was configured to perform the relevant function but that is not in an active state, e.g., a device that is not turned on.

Indeed, this Court observes that, in at least one instance, the Federal Circuit in *Typhoon II* used the phrases "actually perform" and "actually programmed" interchangeably. *See id.* at 1380 (noting that the district construed the claim terms "memory for storing," "processor for executing," and "operating in conjunction with" "as requiring that a device, to be covered by the claim, *actually performs*, or is *configured or programmed to perform*, each of the functions stated in the claim") (emphasis added). This suggests that the Federal Circuit did not draw the same distinction

between performance and configuration that Defendants are attempting to draw in the instant case.

Thus, after a close reading of the *Typhoon* decisions, the Court finds that these decisions do not stand for the proposition that the use of the participle phrase "providing code to" is only satisfied when the memory is actually providing code to the processor, *i.e.* when the device is active. Rather, the phrase "providing code to" means that the memory must be "configured or programmed to" provide code to the processor. *Id.* As will be set forth below, this understanding of the phrase "providing code to" is also consistent with the testimony of Dr. Dinan.

In Defendants' brief, Defendants also cite the district court's decision in *Imperium (IP) Holdings, Inc. v. Apple Inc*. *See* Resp. Br. at 23-24 (citing *Imperium*, 4:11-CV-163, 2012 WL 6949611 (E.D. Tex. July 2, 2012), *report and recommendation adopted as modified*, 4:11-CV-163, 2013 WL 322053 (E.D. Tex. Jan. 28, 2013)). The *Imperium* Court held that terms such as "'setting integration time,' 'providing data,' 'receiving test pixel data,' 'receiving photoelectrons,' etc." did not merely require that the device be "'capable' of performing the function." *Id.*, 2012 WL 6949611 at *27-28. The *Imperium* Court held that these terms required that the aforementioned terms described particular "states, not merely capabilities" and required that the functions "are occurring or have occurred." *Id.* at *28. The *Imperium* Court distinguished the term "providing data" from "language such as 'configured to….'," which might permit devices that were capable of performing the recited function. *Id.* The *Imperium* Court stated that its ruling was required by *Typhoon II* as well as the Federal Circuit's decision in *Ball Aerosol & Specialty Container, Inc. v. Ltd. Brands, Inc.*, 555 F.3d 984, 994 (Fed. Cir. 2009). *Imperium*, 2012 WL 6949611 at *28 (stating that "*Ball Aerosol* and *Typhoon Touch* are binding authorities").

As set forth above, this Court finds that *Typhoon II* does not stand for the proposition that a participle phrase such as "providing code to" requires actual performance as opposed to requiring that devices be actually configured/programmed to perform the recited function. This understanding is also in accord with *Ball Aerosol*. In *Ball Aerosol*, the Federal Circuit held that claim language stating that certain "protrusions" on the end of a candle holder "must be 'resting upon' the cover" was not broad enough to include devices which were not actually "configured" in this manner, even though such devices were "reasonably capable of being configured" in this

manner. *Id.*, 555 F.3d at 994 (requiring that "the accused product [be] configured with the cover being used as a base underneath a candle holder with feet"). Here, GPNE does not dispute that the devices must be configured to provide code to the processor. Accordingly, the Court is not persuaded that either *Typhoon II* or *Ball Aerosol*, the two cases relied upon by the district court in *Imperium*, requires this Court to hold that "providing code to" requires that the function be "actually performed," in the sense that the device must be in an active state, rather than requiring that the memory be "actually programmed" to provide code to the processor.

2. Extrinsic Evidence

Dr. Dinan's testimony also supports construing "providing code to" as requiring that the memory be actually programmed to provide code to the processor. At the outset, the Court notes that each of the claims featuring the "providing code to" language is an apparatus claim. In other words, each claim describes a structure, either a "node" or a "controller." *See* '267 Patent, Claims 1, 25, 30, and 39; '492 Patent, Claims 2, 11, 16, 19, 28, and 37; '954 Patent, Claims 12, 13, 23, 28, and 33.

As explained by Dr. Dinan, because the term "providing code to" appears in the context of apparatus claims, which claim structures, a POSA would understand the term as requiring that the "memory has a *structure* for providing the code." Dinan Dep. at 253:15-255:18 (emphasis added). A POSA would therefore understand the term "providing code to" as requiring that "memory has [the] code so it could provide it." *Id.* Dr. Dinan contrasted apparatus claims with method claims, which claim a series of "steps" that the individual or object practicing the method must undertake. *Id.* at 254:24-255:1. Dr. Dinan opined that when "providing" is used in the context of a method claim, it means that "the memory is going through [a] step" or is in "an active state" of providing code. *Id.* at 254:6-12, 254:24-255:8.

The Court finds Dr. Dinan's testimony to be persuasive. Given that the node and controller claim structures and not methods, a POSA would not view the term "providing code to" as imposing an "actual performance" requirement such that the claim language is not satisfied until the memory is actually prompted to provide code by the user or because of an incoming message from the controller. Rather a POSA would understand "providing code to" as requiring that the

memory be programmed to provide code to the processor when called upon to do so.

3. Conclusion Regarding "providing code to"

For the reasons set forth above, the Court concludes that "providing code to" does not require that the memory actually perform the function of providing code to the processor. Rather, this term requires that the device be programmed so that the memory provides code to the processor when the "transmit" and "receive" functionality is engaged. Thus, the Court rejects Defendants' proposed construction, which seeks to impose an actual performance requirement by requiring that the memory be "currently providing code to."

In rejecting Defendants' proposed construction, the Court does not endorse GPNE's construction. GPNE construes "providing code to" as "capable of making instruction available to." The term "capable" may permit devices that *can be* programmed so that the memory provides code to the processor even though such devices are not actually programmed in this manner. *See Typhoon II*, 659 F.3d at 1380 (rejecting Typhoon's argument that "processor for executing" meant only "that the device has the capability of being programmed or configured to execute the . . . application"). Accordingly, to eliminate any ambiguity, the Court construes "providing code to" as "which is actually programmed to provide code to."[17]

H. "first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal"

Terms in Dispute	GPNE's Proposed Construction	Defendants' Proposed Construction
"first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal"	No construction necessary or, A "first grant signal" (*i.e.*, an initial signal that gives the node permission to transmit additional signals) includes information relating to allocating a second slot to the first node for transmitting the "reserve access request signal" (*i.e.*, a signal sent by the node using resources that are not shared with other nodes which includes	[First grant signal] including information identifying a slot to use for transmitting the 'reserve access request signal,' which the first node identifies as intended for it because the information is transmitted in the same timeslot within which the first node transmitted the 'random access request signal'

[17] GPNE agrees that the memory must be "actually programmed" to provide code to the processor. *See* Reply Br. at 12, 16; Tr. at 115:18-22; 108:14-109:11.

	information related to a node's request for the provision of additional resources for transmitting data packets).	

The term "first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal" ("first grant term") appears in the '267 Patent and the '492 Patent. For example, the '267 Patent discloses:

> 1. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:
>
> at least one processor;
>
> a memory providing code to the least one processor; and
>
> an interface controlled by the least one processor to:
>
> …
>
> receive a first grant signal subsequent to transmission of the random access request signal, said **first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal** for transmitting first data packets containing a message;
>
> …

See id. at 14:60-15:21 (emphasis added). Defendants request construction of this term to clarify the meanings of Claims 1, 30, and 39 of the '267 Patent and Claims 28 and 37 of the '492 Patent. Resp. Br. at 14.

GPNE's proposed construction is divided into three sections addressing the terms: (1) "first grant signal"; (2) "includes information relating to allocating a second slot to the first node for transmitting the"; (3) and "reserve access request signal" respectively. Opening Br. at 8. As noted by Defendants, two of these terms were "first grant signal" and "reserve access request signal" and were separately identified in the parties' Patent Local Rule 4-2 Disclosures and the Joint Claim Construction Statement as terms needing construction. *See* JCCS at 5. However, the parties did not identify these terms, pursuant to Patent Local Rule 4-3, as among the 10 most significant terms whose construction should be addressed at this time. *Id.* Defendants state that they therefore did not address the constructions of "first grant signal" or "reserve access request signal."

The Court agrees with Defendants that, in dividing its proposed construction of the first grant term into three parts and incorporating separate definitions for "first grant signal" and

"reserve access request signal," GPNE is attempting to secure two additional constructions. Because these terms were not identified as among the 10 terms to be construed and were not addressed by Defendants, the Court will not address them either.

As to the larger phrase -- "first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal" -- the parties appear to agree that the "information" in "information relating to an allocation of a second slot" is the identity of a designated time slot in which the node may transmit future reserve access request signals. *See* Resp. Br. at 14; Reply Br. at 9 (acknowledging that the information conveyed by the first grant signal includes "the information granting the second [time] slot" which the node may use to transmit "a later reserved request" signal). Thus, at the June 6, 2013 *Markman* hearing, GPNE agreed to the portion of Defendants' proposed construction providing that the first grant term "includ[es] information identifying a slot to use for transmitting the reserve access request signal." Tr. at 157:17-22.

The parties' dispute is therefore focused primarily on the second clause of Defendants' proposed construction, which requires that "the first node [must] identif[y] [the first grant signal] as intended for" the first node based on the fact that "the information is transmitted in the same timeslot within which the first node transmitted the 'random access request signal'." GPNE contends that this clause attempts to read into the first grant term a limitation regarding "how a node can identify the first grant" signal as being intended for that node. Reply Br. at 9. GPNE argues that this is improper because the first grant term does not describe *how* the node identifies itself as the proper recipient of the first grant signal, but rather describes the *content* (the "what") of the first grant signal. *Id.* at 9-10. In other words, GPNE argues that the first grant term requires only that the first grant signal include the identity of a time slot in which the node can transmit its reserve access request signal, and that the first grant term does not impose a requirement that the node identify the message as intended for the node based on the fact that the message was transmitted in the same random time slot as the node used to transmit its original signal. *Id.*

For the reasons set forth below, the Court rejects Defendants' argument that the first grant term should include a limitation relating to the means by which the node identifies the first grant

signal as intended for the node. Thus, the Court construes the first grant term as "first grant signal including information identifying a slot to use for transmitting the reserve access request signal."

a) Claim Language

As an initial matter, Defendants' proposed limitation regarding how the node identifies itself as the proper recipient of the first grant signal should be rejected because it is not supported by the claim language. The relevant language describes only the content of the information contained in the first grant signal. *See e.g.* '267 Patent at 15:5-8 ("first grant signal including *information* relating to an allocation of a second slot to the first node for transmitting the reserve access request signal") (emphasis added).[18] Thus, the Court finds that the claim language does not support Defendants' proposed construction.

b) Specification

The specification similarly fails to support Defendants' proposed limitation. Defendants' attempt to support their proposed construction with language appearing in the portion of the specification describing the "[o]peration of [the] [s]econd [e]mbodiment." *See* '267 Patent at 11:4; Resp. Br. at 14 (citing '267 Patent at 11:59-64).

As set forth *supra*, in the second embodiment, when a "pager unit" enters an area controlled by a new control station, it transmits a request signal to the station in a random time slot. *See* '267 Patent at 11:43-51. The pager unit then waits for the station response to arrive from the station in the same time slot. *See id.* at 11:52-55. The specification provides that, in the second embodiment, the "pager unit . . . recognizes the [response] message as being addressed to [the] pager unit" based on the fact that the response, which the parties do not appear to dispute is the "first grant signal," is transmitted in the same "randomly generated" time slot as the pager used to transmit its original message. *Id.* at 11:59-64.

[18] Indeed, the Court notes that in certain instances where the inventor intended to include a limitation regarding the means by which the node identifies itself, other, more explicit language was used. For example, Claim 39 of the '267 Patent includes express language stating that the node identifies the first grant signal as intended for the particular node using the randomly generated information. *See, e.g.*, '267 Patent at 19:23-29 ("[W]herein the random access request signal . . . includes randomly generated information . . . , and wherein the first grant returns said randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant.").

Defendants argue that, in light of this discussion in the specification, the Court should include in the construction of the first grant term Defendants' proposed limitation that the node must identify the first grant signal as being intended for the node based on the time slot in which the signal is sent. *See* Resp. Br. at 14-15. Defendants note that the specification discloses the existence of other information, specifically each "pager unit['s] . . . preprogrammed . . . identification serial number," '267 Patent at 4:20-23, that could be inserted in the first grant signal and used to identify the intended recipient of the signal. *See* Resp. Br. at 15. Defendants argue that the inventor's decision to use the randomly generated time slot, instead of some other identifying information, as the mechanism for identifying the intended recipient of the first grant signal in the second embodiment demonstrates an intent to limit the claims. The Court disagrees.

The claim language does not impose any limitations regarding *how* the first node identifies itself as the intended recipient of the first grant signal. While the second embodiment supports Defendants' construction, the Court cannot limit the claim language based on the description of an embodiment unless "the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction.'" *Innova/Pure Water, Inc.*, 381 F.3d at 1117 (citations omitted). Here, there are no "words or expressions . . . manifest[ing]" a clear intent to limit the claims based on the preferred embodiment. *Id.* The fact that the inventor chose to use the randomly generated time slot as the identifying mechanism in the second embodiment, as opposed to some other information, does not provide sufficiently clear evidence of an intent to limit the claims. Accordingly, the Court rejects Defendants' argument that the specification supports including Defendants' proposed limitation.[19]

Because Defendants' proposed limitation is not supported by the claim language or the specification, the Court declines to include it in the construction of the first grant term. Accordingly, the Court construes the first grant term as "first grant signal including information

[19] Defendants also cite as support for their argument a statement by Dr. Dinan acknowledging that Defendants' construction of the first grant term, including the requirement regarding the method of identifying the intended recipient of the first grant signal, is consistent with the specification. *See* Resp. Br. at 15 (citing Dinan Dep. at 168:14-25). This reference is unpersuasive. As set forth above, the Court will not limit the claims based on the embodiments in the specification unless such embodiments "expressly or by clear implication restrict[s] the scope of the invention." *Liebel-Flarsheim*, 358 F.3d at 908

identifying a slot to use for transmitting the reserve access request signal."

I. Allocation of additional resources for transmitting the data packets/allocation of additional resources for transmitting the first data packets

GPNE Proposed Construction	Defendants' Proposed Construction
No construction necessary, or Should the court find construction necessary: "providing additional opportunities for transmitting the first data packets"	"assignment of a second dedicated frequency to the same node for transmitting the message, while retaining the assigned time slot for transmitting the 'reserve access request signal'"

The term "allocation of additional resources for transmitting the data packets/allocation of additional resources for transmitting the first data packets" appears in the '267 Patent and the '492 Patent. For example, the '267 Patent discloses:

> 1. A first node in a data network . . . comprising:
>
> at least one processor;
>
> a memory providing code to the least one processor; and
>
> an interface controlled by the least one processor to:
>
> …
>
> receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an **allocation of additional resources for transmitting the first data packets**…
>
> …

See id. at 14:60-15:21 (emphasis added). Defendants request construction of this term to clarify the meanings of Claims 1, 30, and 39 of the '267 Patent and Claims 28 and 37 of the '492 Patent. Resp. Br. at 11.

Defendants contend that "allocation of additional resources for transmitting the first data packets" should be construed as the "assignment of a second dedicated frequency to the same node for transmitting the message, while retaining the assigned time slot for transmitting the 'reserve access request signal.'" *Id.* At the June 6, 2013 *Markman* hearing, Defendant clarified that "dedicated" is meant to imply that the frequency assigned for the transmission of the data packets is not also used to transmit reserve access request signals and other control signals.[20] *See* Tr. at

[20] The term "control signal" may be found in Defendants' briefing. *See* Resp. Br. at 13.

183:3-16; Resp. Br. at 13 (contrasting between data packets with reserve access request signals and other "control signal[s] that are used by the pager in the process of requesting resources from the control station . . . ."). Defendants also appear to view the term data as applying to "pager status data" as well as "alphanumeric data." Resp. Br. at 13.

GPNE maintains that the term does not need construction or that, if it does, it should be construed only as "providing additional opportunities for transmitting the first data packets." Opening Br. at 18. Notably, at the June 6, 2013 *Markman* hearing, GPNE agreed that the additional resource is a frequency. Tr. at 179:23-180:6. However, GPNE disputes whether this frequency must be "dedicated" to the transmission of "data packets." *See id.*; *id.* at 184:1-16.

Thus, the parties' dispute as to the proper construction of this term turns on two issues. First, the parties dispute whether the additional resource assigned for the transmission of the data packets must be a *dedicated* frequency. Resp. Br. at 11. Second, the parties dispute whether the node must "retain[] the assigned time slot for transmitting the 'reserve access request signal.'" *Id.* The Court addresses each of these issues in turn.

1. Allocation of a dedicated frequency

a) Claim Language

The Court first turns to the claim language. Significantly, the claims in the '267 and '492 Patents generally do not include any limitations regarding the frequency upon which messages and other signals are transmitted. *See, e.g.*,'267 Patent at col. 14:60-15:16 ("**1.** A first node in a data network . . . to: receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an allocation of additional resources for transmitting the first data packets." (emphasis in original)). Where such limitations were intended, explicit language was used. For example, Claim 39 of the '492 Patent expressly provides that "the aligning signal . . . the reserve access request signal . . . [and] the data packets are transmitted . . . on differing frequencies . . . ." '492 Patent at 21:44-51.[21] Thus, the claim

[21] Plaintiffs note that Claim 2 of the '267 Patent, which depends on Claim 1, adds the limitation that "the first grant, the reserve request signal, the second grant signal, and the first data packets [must be] provided on differing frequencies." *Id.* at 15:22-24. However, as noted by Plaintiffs, the purpose of a dependent claim is to add limitations which are *not* already present in the independent claims. Thus, it would be improper to infer from Dependent Claim 2 that, in Claim 1, the first data

language does not expressly support Defendants' position that, in all instances, the additional resource must be a "dedicated" frequency.

While not cited by the parties, the Court additionally observes that Claim 38 of the '267 Patent, which depends from Claim 30, and Claim 36 of the '492 Patent, which depends from Claim 28, expressly claim nodes "wherein the first data packets are transmitted in at least one slot separate from the recurring second slot . . . ." '267 Patent at 18:61-62; '492 Patent at 21:6-7. The "second slot" is the time slot in which the node transmits its "reserve access request signal." *See, e.g.*, '267 Patent at 18:4-9; '492 Patent at 18:9-15. The statement that the "data packets may be transmitted in [a] … slot separate from the . . . second slot," '267 Patent at 18:61-62, suggests that, in the embodiment claimed by the dependent claims, data packets are transmitted on the same slot-divided frequency that is used to transmit the reserve access request signal and need not be transmitted on a dedicated frequency. Given that independent claims are broader in scope than dependent claims, it follows that the "additional resources" referred to in the independent claims of the '267 Patent and '492 Patent need not be a dedicated frequency. *Cf Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 988 (Fed. Cir. 1988) (referring to the "broader independent claims").

Thus, the Court finds that the claim language fails to support Defendants' argument that the additional resources must be a dedicated frequency. Resp. at 13.

b) Specification

The specification also fails to support Defendant's proposed limitation. In support of Defendants' position, Defendants identify a statement describing the first embodiment: "The third frequency (f_3) carries pager status data and alphanumeric data from paging unit **22** to central control station **20**. The fourth frequency (f_4) carries a pager request signal from paging unit **22** to central control station **20**." *Id.* at 4:37-41; *id.* at 6:21-23 ("At step **138**, central control station **20** receives a communications message on frequency f_3 sent from the sending (e.g., requesting) pager unit **22**."). Even assuming *arguendo* that this statement supports Defendant's

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packets must be transmitted on a different frequency than the control signals. *See Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 988 (Fed. Cir. 1988) ("An accepted rule of claim construction suggests that, since the dependent claims 8 and 16 add an external plasticizer as a limitation, the broader independent claims 1 and 11 do not have this limitation.") (citation omitted).

position, the statement appears in the context of describing a preferred embodiment and does not clearly limit the scope of the overall invention. *See, e.g.*, *Innova/Pure Water*, 381 F.3d at 1117.[22]

The Court additionally notes that, under the "Summary" heading, the specification provides that: "a third local frequency carries communication packets from the pager units to the central control station[,] and a fourth local frequency carries a status or request signal from the paging units to the central control station." '267 Patent at 2:3-9 ("Summary Statement"). The Court acknowledges that this statement, which, unlike the statement above, is not specifically associated with an embodiment, describes communications data as being sent on the third frequency and request signals as being sent on a separate, fourth frequency. However, it is clear that the purpose of this statement is to impose a limitation on invention that would prohibit communications data from being transmitted on the same frequency as the request signal. Accordingly, the Court declines to adopt Defendants' construction based on this statement.[23]

Thus, for the reasons set forth above, the Court finds that the specification does not support Defendants' proposed construction wherein the resource assigned for the transmission of the first

[22] Defendants also appear to argue that the frequency on which communications data is transmitted cannot be the same as the frequency on which control signals, like the reserve access request signal, are transmitted because control signals are transmitted on the fourth frequency, which is divided into time slots, and the specification does not discuss transmitting communications on a frequency which is divided into time slots. *See* Resp. Br. at 12-13. The fact that the specification does not discuss transmitting communications data in a time slot does not foreclose the possibility that the Patents encompass within their scope inventions wherein communications data is transmitted in a time slot. *See, e.g.*, *SunRace Roots Enter. Co., Ltd. v. SRAM Corp.*, 336 F.3d 1298, 1305 (Fed. Cir. 2003) ("'An applicant is not required to describe in the specification every conceivable and possible future embodiment . . . .'" (citation omitted)). Moreover, as discussed *supra*, several of the dependent claims in the '267 and '492 Patents expressly state that data may be transmitted in time slots.

[23] Moreover, construing the Summary Statement as prohibiting the transmission of data packets on a non-dedicated frequency would be inconsistent with the first embodiment. The Summary Statement describes "status . . . signals" as being transmitted on the fourth frequency. '267 Patent at 2:6. However, the description of the first embodiment provides that "pager status data" is transmitted on the "third frequency . . . ." *Id.* at 4:37-41. While it is not clear from the specification, it appears that the term "*status* . . . signal[]," *id.* at 2:6 (emphasis added), describes the signal upon which "pager *status* data," *id.* at 4:37-41 (emphasis added), is transmitted. *See* Tr. at 181:23-182:11 (acknowledging that signals are the means by which data is transmitted on a frequency); Resp. Br. at 13 (describing "'pager status ***data*** and alpha numeric ***data***'" as "two signals" (citation omitted)). Thus the terms "status signal" and "pager status data" both appear to describe the status information. Given that the specification describes status information as being sent on the third frequency in the Summary Statement and status information as being sent on the fourth frequency in the first embodiment, it does not appear that frequencies are limited to carrying one type of information. *See id.* at 2:6, 4:37-41. This undermines Defendants' contention that the data packets cannot be transmitted on a frequency that also transmits control signals.

data packets must be a "second dedicated" frequency.

c) Other Evidence

Defendants argue that their position that the additional resource assigned for the transmission of the data packets is a dedicated frequency is also supported by the deposition testimony of Gabriel Wong, the original inventor. The Court disagrees. During his deposition, Mr. Wong remarked that the third frequency was used "to transmit pager status and alphanumeric data" and that request signals were transmitted on the fourth frequency. *See* Green Decl., Ex. 16 (Wong Deposition Transcript) at 100:22-101:8. However, Mr. Wong also explicitly caveated that he was commenting on the "preliminary . . . [patent] disclosure" he gave to his lawyer in 1994 and that the patent subsequently "evolved." *Id.* at 99:21-100:12. Accordingly, the Court is not persuaded that Mr. Wong's statements provide a sufficient basis to conclude that data packets containing communications/messages may only be transmitted on a frequency which is dedicated for this purpose. *Cf id* at 99:18-20 (discussing the functions of the first frequency and what information is conveyed on that frequency and remarking that "[a]s far as I can recall now, the system is flexible…it can do other things"). Defendants' proposed construction is also undermined by the testimony of Dr. Dinan. *See* Dinan Decl. ¶ 57 (stating that the specification does not restrict "the possibility that a particular frequency could, for example, contain other types of signals, if needed" and that providing different types of signals on the same frequency was "the norm in prior large-scale communication systems as it is in the present").

d) Conclusions Regarding Dedicated Frequency

For all the reasons set forth above, the Court concludes that the allocated resource need not be a "dedicated" frequency as Defendants contend. Plaintiffs have proposed that the allocation of additional resources term be construed as resources "providing additional opportunities for transmitting the first data packets." Opening Br. at 18. However, this construction is ambiguous to the extent it fails to explain what "opportunities" means. Accordingly, the Court will incorporate the following language into the construction of "additional resources for transmitting the data

packets": "assignment of a frequency[24] to the same node for transmitting the message."

2. Retention of Assigned Time Slot

With respect to whether or not a node must retain its assigned reserve access time slot, GPNE concedes that nodes "may regularly keep" their time slot and use this same time slot to transmit additional requests to the control station. Reply Br. at 7. However, GPNE takes issue with including Defendants' proposed limitation -- "while retaining the assigned time slot for transmitting the 'reserve access request signal'" -- because there are circumstances in which a node might change its time slot, *e.g.* when the node goes into another cell, goes idle, shuts-down, or goes in "any other number of states where a new reserved access slot would be assigned." Opening Br. at 21 (citing Dinan Decl., ¶ 59).[25] Moreover, GPNE argues that, even if Defendants' construction was modified to acknowledge the circumstances under which a node may change its time slot, Defendants' retention of time slot limitation would still be inappropriate because this characteristic of the device is not relevant to the claim term being construed -- allocation of additional resources for transmitting the data packets. *See* Tr. at 190:15-22. GPNE argues that Defendants are attempting to "read[] in a separate concept." *Id.* at 200:4-5. For the reasons set forth below, the Court rejects Defendants' retention of time slot limitation.

The claim language provides that a node may be assigned "additional resources for transmitting the first data packets." *See, e.g.*, '267 Patent at 15:15-16. Defendants contend that the word "additional" means that the new resource is being added to the previous resources such that the node must "maintain[] . . . the previously allocated resource[]," the second slot. Resp. Br. at 12 (internal quotation marks omitted). GPNE argues that the term additional is simply intended to indicate that the new resource is: (1) not the time slot that was used to transmit the request signal,

[24] The Court notes that some of Defendants' arguments seem to suggest that the allocation of a frequency cannot include the allocation of a time slot on frequency that is divided into time slots. *See* Resp. Br. at 12-13. In stating that the additional resource is a "frequency," this Court is not excluding inventions where a time slot on a time-divided frequency is assigned.

[25] Defendants dispute that the device necessarily gets a new time slot when it is turned off and powered back on or when the device returns from an idle state. *See* Tr. at 193:15-194:11 (discussing Figure 5 and noting that the "Turn 'Off'" and "Turn 'On'" boxes on the program flow chart do not lead to the "Change to New Time Slot" box); *see also* '267 Patent, Fig. 5. Defendants acknowledge, however, that a device receives a new time slot when it enters a new cell. *See* Tr. at 197:21-23.

and (2) being used "for a separate new purpose," specifically the transmission of data packets. Reply Br. at 9. Ultimately, the Court finds that the meaning of the term "additional" in the claim language is ambiguous. It is not clear that the term is being used to indicate that the node must retain its previously allocated resource. Consequently, the Court declines to adopt Defendants' proposed limitation based solely on the use of the term "additional" in the claim language.

Defendants also contend that the specification describes the pagers as retaining their time slots for use in transmitting future request signals and that this factor supports Defendants' proposed construction. *See* Resp. Br. at 12 (citing '267 Patent at 6:60-62, 8:37-41, and 12:12-16). However the statements Defendants rely upon describe the preferred embodiments and are not clearly limiting. *See Innova/Pure Water, Inc.*, 381 F.3d at 1117. Moreover, the specification describes circumstances in which the pager changes time slots. *See, e.g.*, '267 Patent at 8:34-41 (discussing the "time slot changing sub-routine"); *id.*, Fig. 5 (diagramming sequence of events that occur when a pager changes its time slot).

Finally, Defendants argue that GPNE's statements during the re-examination of the '492 Patent support Defendants' proposed limitation. *See* Resp. Br. at 12 (citing Green Decl., Ex. 15 at 12). Specifically, Defendants refer to statements by GPNE distinguishing the prior art. In the prior art system, a new "channel" would be assigned as a replacement for a previously allocated channel for the purpose of voice communications. Green Decl., Ex. 15 at 12. In distinguishing this art GPNE stated:

> The ASSIGNMENT COMMAND message presumably carries information about a new channel. Although a channel can be viewed as a "resource," it is certainly not "an additional resource." This is because the mobile station has the same communication resources before and after the channel change. At best, this new channel would simply be a replacement for a previously allocated resource, and not an "additional resource."

Id. Defendants argue that these statements show that, in GPNE's view, the "allocation of *additional* resources requires retaining any *previously allocated* resources." Resp. Br. at 12.

GPNE responds that its distinction between GPNE's invention and the prior art was that, in the prior art, the new resource (the new channel) is assigned to carry out the "same task" as the old resource (voice communications). Reply Br. at 8. GPNE argues that, in its invention, the

additional resources are not used for the same purpose as the previous resources (transmitting the reserve access request signal) and are instead used for a new purpose (transmitting data packets). The Court is skeptical of GPNE's explanation. Indeed, certain portions of GPNE's re-examination statement strongly suggest that GPNE viewed the term "additional" as requiring that new resources are being added to the old resources, which are retained. *See* Green Decl., Ex. 15 at 12 (stating that the new channel is not an additional resource "because the mobile station has the same communication resources before and after the channel change."). Nevertheless, it would not be proper for the Court to limit the claims based on GPNE's statement unless those statements clearly support the limitation. *See Cordis Corp. v. Boston Scientific Corp.*, 561 F.3d 1319, 1329 (Fed. Cir. 2009) ("A disclaimer must be 'clear and unmistakable,' and unclear prosecution history cannot be used to limit claims." (citation omitted)). In this case, GPNE did not make a clear and unmistakable disclaimer that "additional" means the node must retain its time slot.

Accordingly, for the reasons set forth above, the Court rejects Defendants' retention of time slot limitation.

3. Conclusion re: the Allocation of Additional Resources Term

For the reasons set forth above, the Court construes "allocation of additional resources for transmitting the data packets/allocation of additional resources for transmitting the first data packets" as meaning: "An assignment of a frequency to the same node for transmitting the message."

J. "clocking signal"

GPNE Proposed Construction	Defendants' Proposed Construction
A signal that contains timing information used for allocating resources	A signal generated by a clock unit

The term "clocking signal" appears in all three Patents. For example, the '267 Patent discloses:

> 4. The first node of claim 1, wherein the interface is further configured to receive a clocking signal with which the first node can synchronize signals.

Id. at 14:30-32 (emphasis added). Defendants request construction of this term to clarify the meanings of Claim 4 of the '267 Patent and Claim 13 of the '954 Patent. Resp. Br. at 8.

The parties' proposed constructions differ in two key respects. First, Defendants' construction includes the limitation that the signal must be generated by a specific piece of hardware, a "clocking unit." Second, GPNE's construction states that the content of the signal is "timing information" that is "used for allocating resources." The parties each contend that additional language included by the other party is improper for various reasons. *See* Opening Br. at 22-23; Resp. Br. at 8-11. For the reasons set forth below, the Court construes "clocking signal" as "a signal that, among other things, contains timing information used for allocating resources."

The Court addresses in turn: (1) GPNE's proposal that the construction of clocking signal disclose that it "contains timing information used for allocating resources," and (2) Defendants' proposal that the construction disclose that the signal is "generated by a clock unit."

1. GPNE's Proposed "Timing Information" and "Allocating Resources" Language

a) Intrinsic Evidence and GPNE's Statements at the June 6, 2013 *Markman* Hearing

At the June 6, 2013 *Markman* hearing, Defendants agreed that GPNE is correct that the clocking signal may contain timing information used for allocating resources. *See* Tr. at 158:24-160:9. The claim language and the specification also support this conclusion. *See, e.g.,* '267 Patent at 4:47-49 ("The predetermined time slot on frequency f_4 is related to the clock-aligning signal (carried by frequency f_1) . . . ."); *id.* at 16:17-19 ("The first node of claim 15, wherein the interface is further configured to receive a clocking signal with which the first node can synchronize signals."); '492 Patent at 21:62-64 (stating that the "aligning signal[1]" is used to "synchronize signals"); '954 Patent at 17:22-24 (same); *id.* at 16:59-60 (stating that the "clocking signal is used to enable requests including a first request from the first node"); *id.* at 2:15-17 (disclosing that each node receives a time slot in which it may transmit reserve access requests).

Defendants nevertheless argue that the Court should not adopt GPNE's construction because it implies that the clocking signal is only used for timing information and to allocate resources. *See* Tr. at 158:24-160:9; Resp. Br. at 11 (arguing that the "clocking signal 'does not have to be used to allocate resources'") (quoting Dinan Dep. at 92:24-93:8). GPNE agrees that its construction may be modified to state, "the signal that, *among other things*, contains timing

information used for allocating resources." *See* Tr. at 172:15-19 (emphasis added). The Court finds this amendment sufficient to address Defendants' concern that the clocking signal may be used for purposes other than to allocate resources.

b) GPNE's Alleged Disclaimer

In Defendants' briefing, Defendants also argued that GPNE's inclusion of the "timing signal" language is improper because GPNE's language is intended to serve as "a proxy for [the concept of] 'synchronization'." Resp. Br. at 9. Defendants argue that the concept of "synchronization" is important "because it maps the 'clocking signal' to an aspect of the accused GPRS protocol known as a 'synchronization burst.'" *Id.* Defendants argue that this is improper because GPNE "clearly disavowed 'synchronization signals' from the scope of its claims." *Id.*

Defendants argument is based on several amendments made during the course of prosecuting the Patents. Defendants note that, in prosecuting the '954 Patent, GPNE amended its claims to replace "request-enabling-synchronization signal" with "clocking signal" in response to concerns expressed by the Examiner that a "request-enabling-synchronization signal" was not disclosed in the written description (the term "clocking signal" was disclosed in the description). *See, e.g.*, Green Decl., Ex. 12 at GPNECorp. 00000772; *id.*, Ex. 14 at GPNECorp. 0000082. Furthermore, Defendants note that, in addressing issues relating to the term "aligning signal" during the pending re-examination of GPNE's '492 Patent, GPNE indicated that it agreed with Defendants that "synchronization and alignment are different." *Id.*, Ex. 15, ECF No. 72-16 at 12 of 31 ("[B]y the Requestor's own admission in District Court, synchronization and alignment are different"). Defendants' reliance on these references is misplaced.

First, as set forth above, the claim language and specification make clear that "clocking signal" provides "timing information." *See, e.g.*, '267 Patent at 4:47-49, 16:17-19; '492 Patent at 21:62-64; '954 Patent at 17:22-24, 16:59-60. Assuming *arguendo* GPNE disclaimed the concept of synchronization, the Court is not persuaded that the construction should not disclose that the clocking signal is used to provide "timing information" simply because the phrase "timing information" is similar to the term "synchronization."

Second, it is not clear that GPNE disclaimed the concept of synchronization. *See Verizon*,

503 F.3d at 1306 ("To operate as a disclaimer, the statement in the prosecution history must be clear and unambiguous, and constitute a clear disavowal of scope." (citations omitted)). While GPNE was required to remove the term "request-enabling-synchronization signal," GPNE was not required to remove the numerous other descriptions of the clocking signal as a synchronizing signal in the claim language. *See, e.g.*, '267 Patent at 17:34-36 (referring to "a clocking signal with which the first node can synchronize signals"); '492 Patent at 21:62-64; '954 Patent at 17:22-24.

Third, with respect to GPNE's statement during the recent reexamination that "synchronization and alignment are different," *see* Green Decl., Ex. 15 at 12 of 31 ("Further, by the Requestor's own admission in District Court, synchronization and alignment are different"), Defendants' reliance on this statement is misplaced. As set forth above, the fact that Defendants believe that the phrase "timing information" comes too close to the concept of synchronization does not provide a sufficient basis to exclude the phrase "timing information" for the construction of "clocking signal" to the extent that phrase is otherwise accurate. Moreover, GPNE's reference to "synchronization" in the cited statement was not meant to disclaim or distinguish synchronization as a general concept. Rather GPNE was distinguishing its clocking signal from the "synchronization channel"/"SCH" "burst," a specific concept found in certain prior art. *See id.* ("According to page 206, mobile stations sporadically receive a burst from SCH to synchronize with adjacent cells in preparation for a handoff. *Mouly* describes this procedure as 'pre-synchronization.' This does not appear to be an 'aligning signal which enables the mobile station to transmit' SERVICE REQUEST."). Thus, the Court is not persuaded that GPNE has generally disclaimed that its clocking signal may be used to synchronize the devices with the controllers or that the phrase "timing information" should be excluded from the construction of clocking signal.

c) Conclusion re: "Timing Information" and "Allocating Resources"

For the reasons set forth above, the Court concludes that the construction of "clocking signal" should disclose that it is a "signal that, among other things, contains timing information used for allocating resources." The Court proceeds to consider whether the construction of clocking signal should, as Defendants contend, disclose that the signal is generated by a clock unit.

2. Defendants' Argument that the "Clocking Signal" is Generated by a "Clock Unit"

a) Claim Language/Specification

The claim language does not disclose that the clocking signal is generated by a clock unit. Nevertheless, the specification states in the "Detailed Description" that the clocking signal is generated by the clocking unit. *See, e.g.*, '267 Patent at 3:27-29 ("Central control station **20** also includes a clock unit **59** which generates a local clock signal $f_1$clk (which, in turn, is used to modulate frequency f_1)."); *id.* at 4:8-10 (stating that the "clock unit **87** generates a local clock signal"). However, the "Detailed Description" appears to describe the preferred embodiments. *See, e.g.*, *id.* at 2:63-67 ("Detailed Description[.] FIG. **1** shows a central control station **20** according to a first embodiment of the invention; FIG. **2** shows a paging unit **22** suitable for use with central control station **20**."). Thus, the Court cannot conclude that the statements regarding the "clocking signal" contained therein are limiting, *i.e.* that the clocking signal *must* be generated by a clock unit. *See Innova/Pure Water, Inc.*, 381 F.3d at 1117 (holding that "particular embodiments appearing in the written description will not be used to limit claim language that has broader effect"). Nevertheless, because the specification acknowledges that, in at least one embodiment, the clocking signal is generated by a clock unit, it follows that the clocking signal *may* be generated by a clock unit.[26]

b) GPNE's Remaining Arguments

In GPNE's Opening Brief and at the June 6, 2013 *Markman* hearing, GPNE argues that, while it is technically accurate to say that the clocking signal can be generated by a clock unit, describing the clocking signal in terms of its source shifts the focus away from *what* the clocking signal is to *how* it is generated. *See* Tr. at 171:7-24. GPNE also argues that inserting the term "clock unit" into the construction of "clocking signal" does little to clarify the meaning of clocking signal because it leaves the question open as to what a clock unit is. *See id.* at 168:13-17. The

[26] Dr. Dinan's testimony similarly supports the conclusion that a clocking signal may, but need not be, generated by a clock unit. *See* Dinan Decl. ¶ 38 (stating that it is "technically accurate" that a clock unit is "*one way* to create a type of clocking signal disclosed in the patent," but cautioning that the clocking signal is not properly "understood" as a signal generated by a clock unit, but rather "as a type of synchronization signal . . . [that allows] nodes and the central control station [to] be aligned in time").

Court agrees with the latter argument. While it is true that the clocking signal may be generated by a clock unit, the addition of the undefined term "clock unit" does little to clarify what a clocking signal is. Moreover, unlike the word "pager" discussed *supra* in connection with the term "node," the term "clock unit" is not essential to the definition of "clocking signal" because the clocking signal need not necessarily be generated by a clock unit. Given that: (1) the clocking signal need not be generated by a clock unit, and (2) the term clock unit is itself undefined and therefore does little to clarify the meaning of clocking signal for jurors, the Court declines to include "clock unit" in the construction of "clocking signal." However, Defendants are not precluded from arguing during trial that the clocking signal may be generated by a clock unit.

3. Conclusion Regarding "Clocking Signal"

For the reasons set forth above, the Court construes "clocking signal" as "a signal that, among other things, contains timing information used for allocating resources."

II. CONCLUSION

For the reasons discussed above, the Court construes the disputed claim terms as follows:

Claim Language	Construction
"node"	"pager with two-way data communications capability that transmits wireless data communications on a paging system that operates independently from a telephone network."
"frequency"	"a number expressed in hertz"
"randomly generated information"	"[i]nformation that is randomly generated."
"count value"	"[t]he number of consecutively related packets emanating from a transmitter"
"interface[configured/controlled] by the at least one processor to [transmit and receive terms]"	"Electronic circuitry which is configured/controlled by the processor(s) according to instructions in the memory, that allows the processor(s) to communicate with a transceiver"
"providing code to"	"which is actually programmed to provide code to"
"first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request	"first grant signal including information identifying a slot to use for transmitting the reserve access request signal"

signal”	
“allocation of additional resources for transmitting the data packets/allocation of additional resources for transmitting the first data packets”	“An assignment of a frequency to the same node for transmitting the message.”
“clocking signal”	“A signal that, among other things, contains timing information used for allocating resources.”

IT IS SO ORDERED.

Dated: August 13, 2013

LUCY H. KOH
United States District Judge

Exhibit 4

US007792492B2

(12) **United States Patent**
Wong et al.

(10) **Patent No.: US 7,792,492 B2**
(45) **Date of Patent: Sep. 7, 2010**

(54) **NETWORK COMMUNICATION SYSTEM WITH AN ALIGNMENT SIGNAL TO ALLOW A CONTROLLER TO PROVIDE MESSAGES TO NODES AND TRANSMISSION OF THE MESSAGES OVER FOUR INDEPENDENT FREQUENCIES**

(75) Inventors: **Gabriel K. Wong**, Honolulu, HI (US); **Po S. Tsui**, Honolulu, HI (US)

(73) Assignee: **GPNE Corp.**, Honolulu, HI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 56 days.

(21) Appl. No.: **11/747,737**

(22) Filed: **May 11, 2007**

(65) **Prior Publication Data**

US 2007/0210897 A1 Sep. 13, 2007

Related U.S. Application Data

(60) Continuation of application No. 11/668,922, filed on Jan. 30, 2007, now abandoned, which is a continuation of application No. 11/350,616, filed on Feb. 8, 2006, now Pat. No. 7,200,406, which is a continuation of application No. 09/847,005, filed on May 2, 2001, now Pat. No. 7,031,716, which is a continuation of application No. 09/594,662, filed on Jun. 15, 2000, now Pat. No. 6,282,406, which is a continuation of application No. 09/259,417, filed on Dec. 9, 1997, now Pat. No. 6,108,520, which is a continuation of application No. 08/608,629, filed on Feb. 29, 1996, now Pat. No. 5,729,827, which is a division of application No. 08/264,973, filed on Jun. 24, 1994, now Pat. No. 5,542,115.

(51) **Int. Cl.**
H04B 7/00 (2006.01)

(52) **U.S. Cl.** **455/66.1**; 370/347
(58) **Field of Classification Search** 455/450
See application file for complete search history.

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(Continued)

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(57) **ABSTRACT**

A communication system with at least one controller and a plurality of nodes provides a procedure to enable the controller to connect and send messages to individual nodes to establish and maintain a communication link. The controller further receives an indication from the node when termination of receipt of a message from the controller by the node has occurred. The controller transmits connection information to a node to establish a communication path over which the controller can transmit a message to the node when the controller has information to send. A communication message can be sent by the controller, for example, when a node wanders into its control area to enable a communication link to be established.

73 Claims, 13 Drawing Sheets

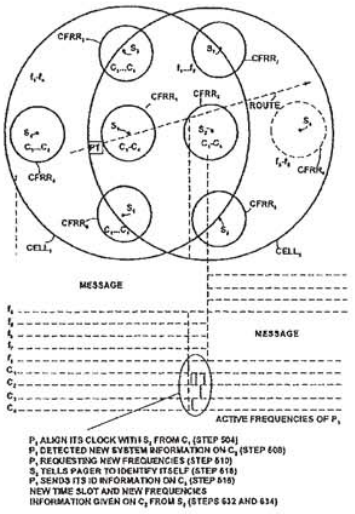

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Exhibit A—Samsung Telecommunications America's First Supplemental Invalidity Contentions—Claim Chart—Mobitex Interface Specification (Mobitex) Against the Asserted Claim of the '406 Patent.

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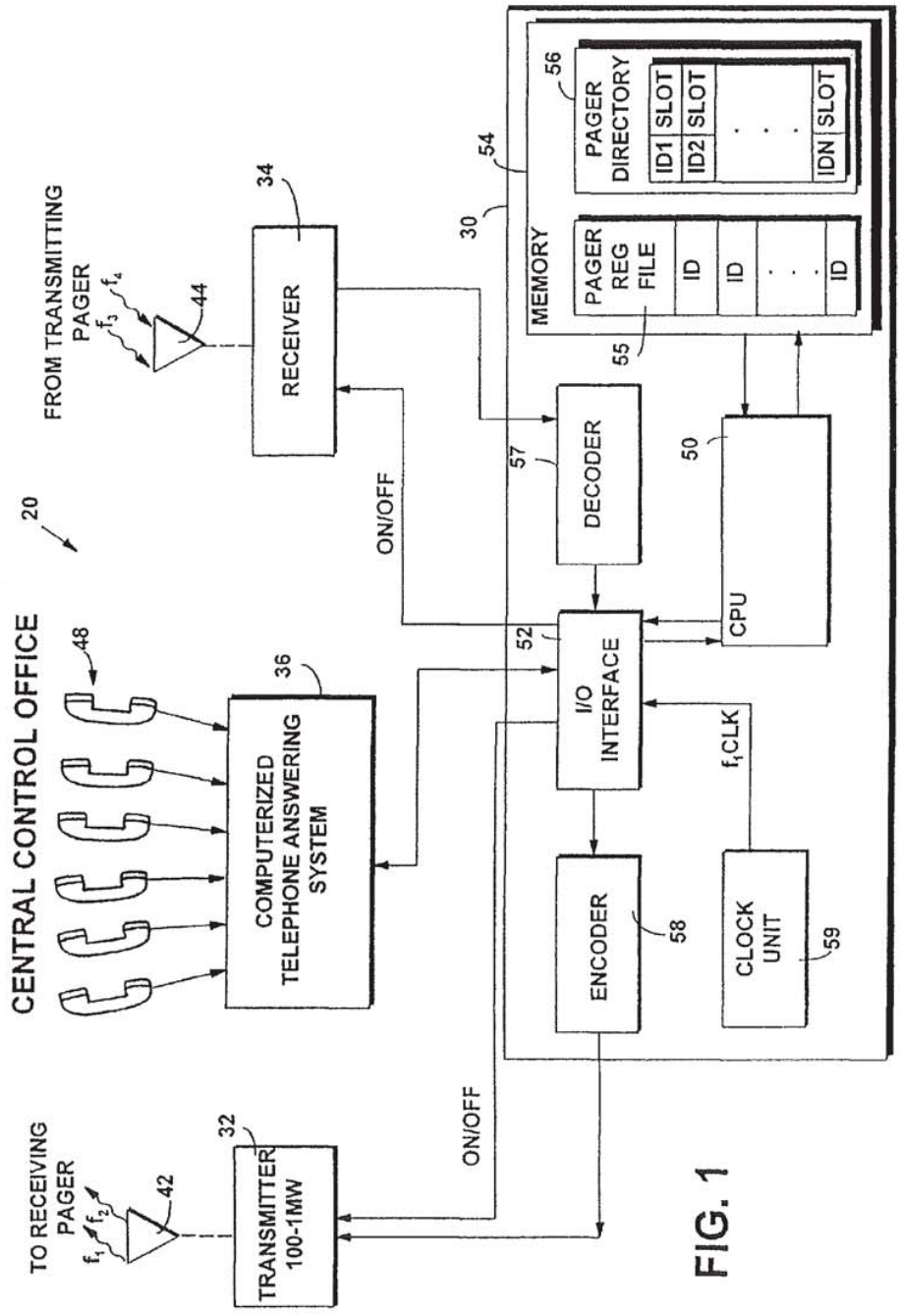

CENTRAL CONTROL OFFICE
20
FROM TRANSMITTING PAGER
f_3 f_4
44
RECEIVER
34
ON/OFF
30
MEMORY
54
PAGER DIRECTORY
56
ID1 SLOT
ID2 SLOT
IDN SLOT
PAGER REG FILE
55
ID
ID
ID
57
DECODER
50
CPU
52
I/O INTERFACE
f_1CLK
48
36
COMPUTERIZED TELEPHONE ANSWERING SYSTEM
ENCODER
58
CLOCK UNIT
59
TO RECEIVING PAGER
f_1 f_2
42
32
TRANSMITTER 100-1MW
ON/OFF

FIG. 1

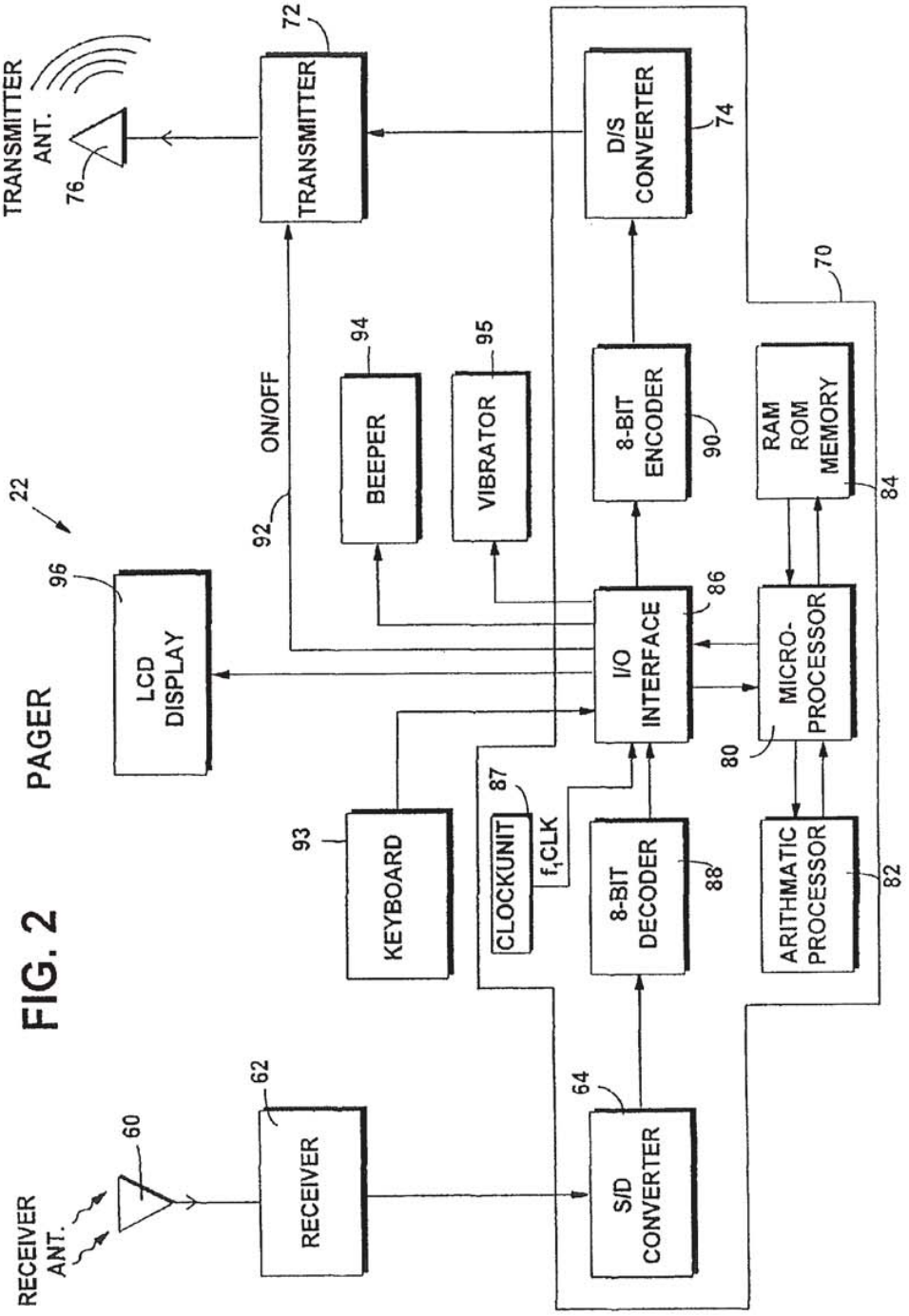
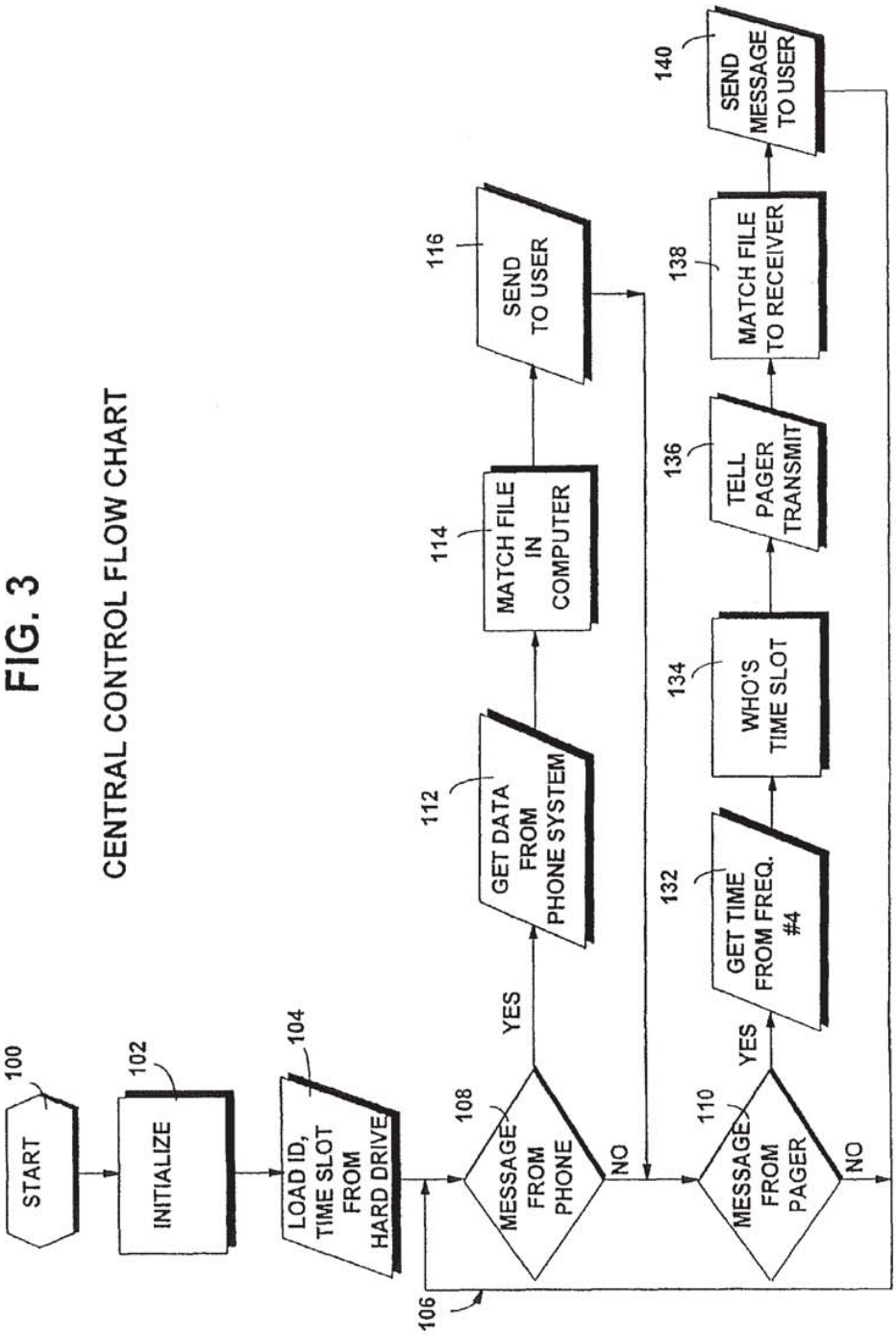

PAGER
22
TRANSMITTER ANT.
76
TRANSMITTER
72
D/S CONVERTER
74
70
ON/OFF
92
BEEPER
94
VIBRATOR
95
8-BIT ENCODER
90
RAM ROM MEMORY
84
LCD DISPLAY
96
I/O INTERFACE
86
MICRO-PROCESSOR
80
KEYBOARD
93
CLOCKUNIT
87
f1CLK
8-BIT DECODER
88
ARITHMATIC PROCESSOR
82
RECEIVER ANT.
60
RECEIVER
62
S/D CONVERTER
64

FIG. 2

FIG. 3

CENTRAL CONTROL FLOW CHART



PAGER TRANSMITTER PROGRAM FLOW CHART

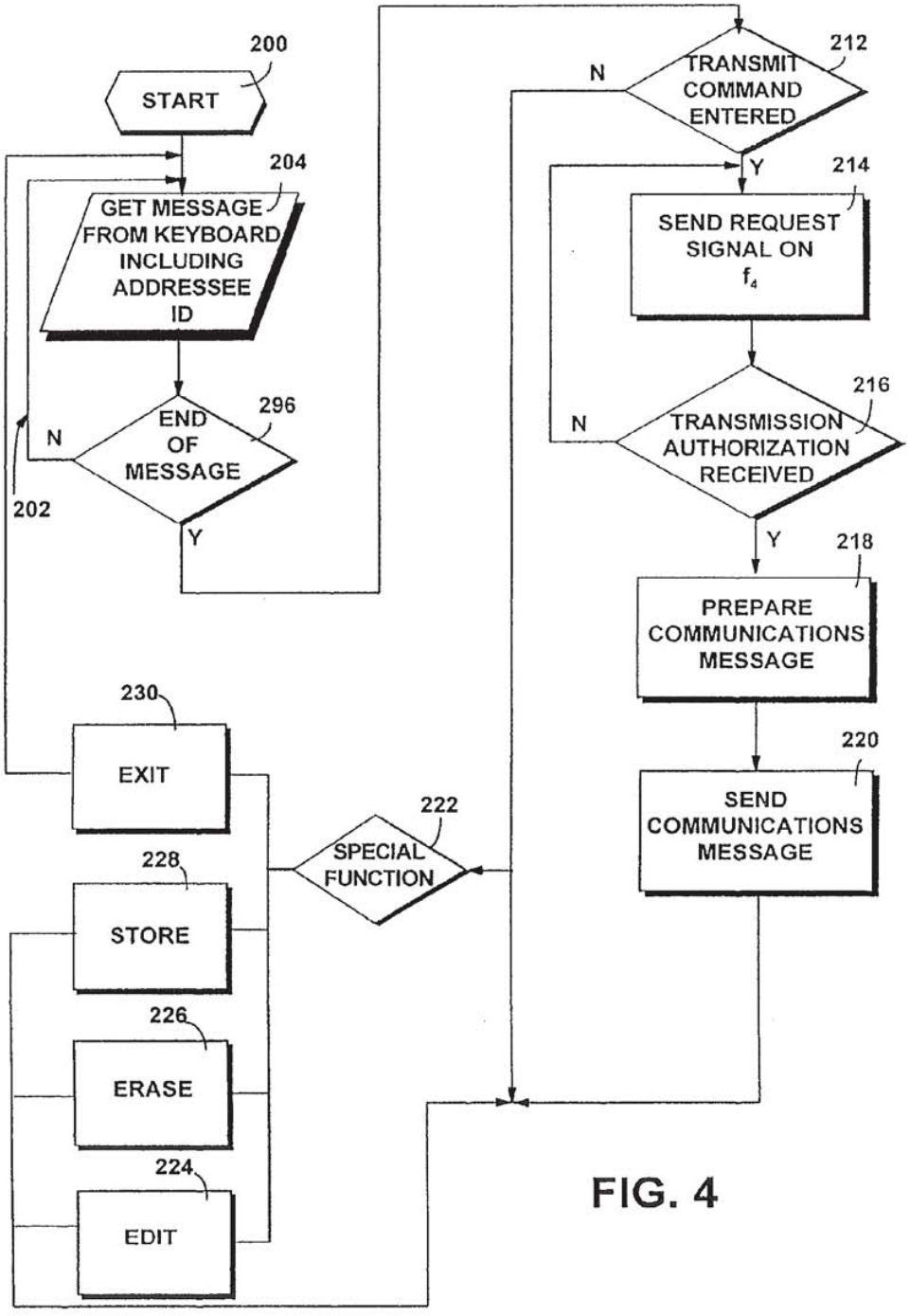


FIG. 4

FIG. 5

PAGER RECEIVER PROGRAM FLOW CHART

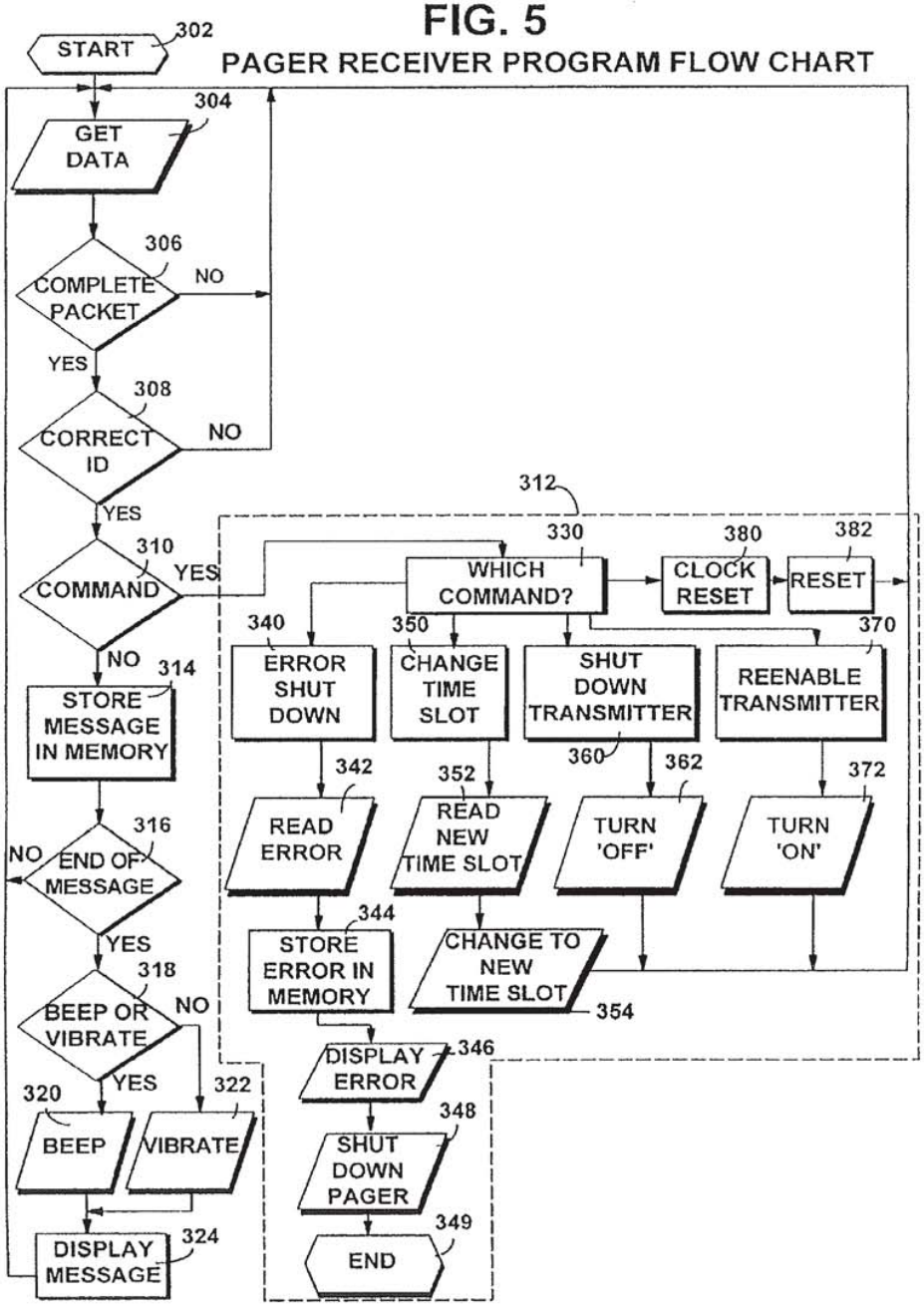


FIG. 6

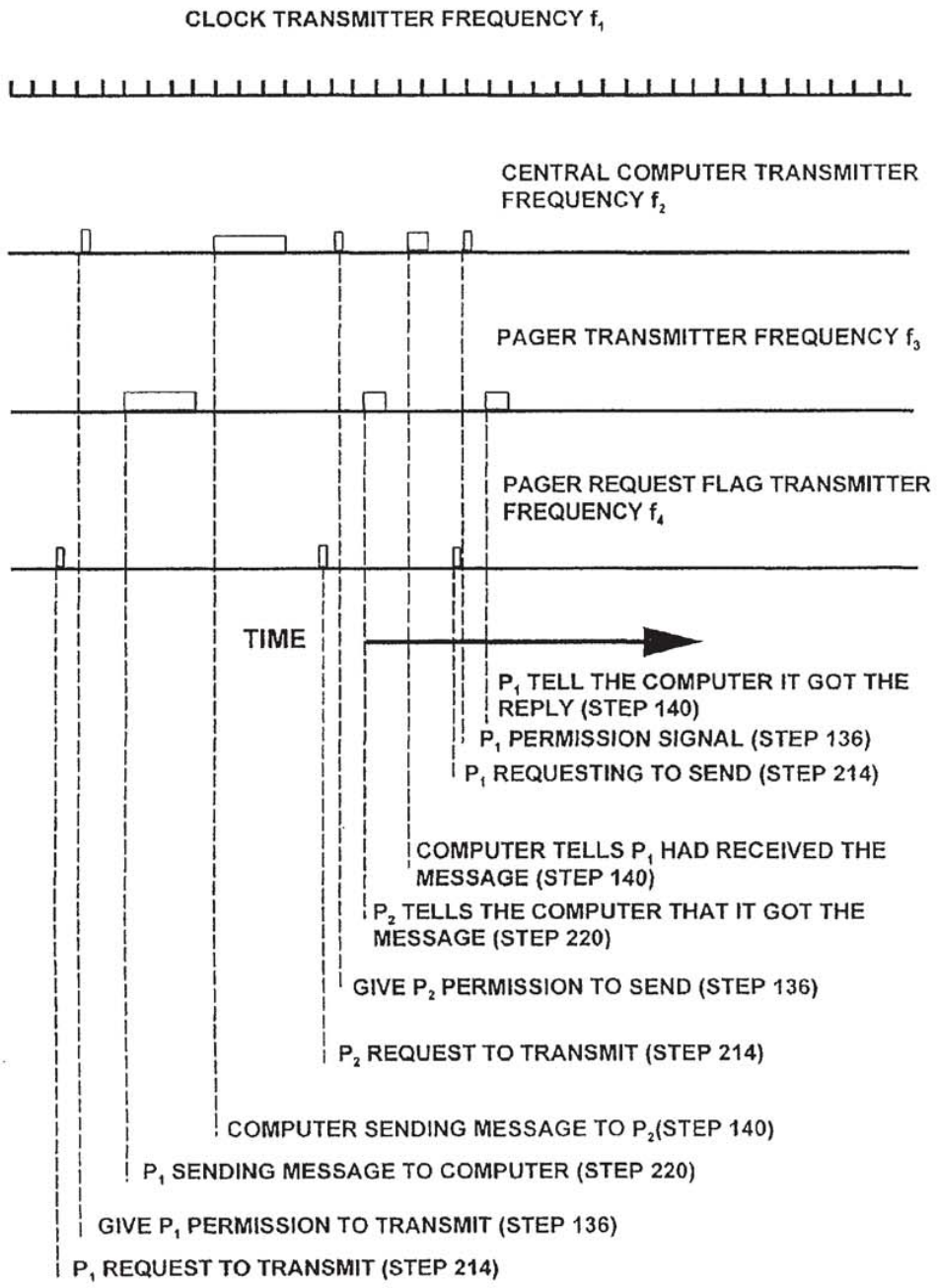

CLOCK TRANSMITTER FREQUENCY f_1
CENTRAL COMPUTER TRANSMITTER FREQUENCY f_2
PAGER TRANSMITTER FREQUENCY f_3
PAGER REQUEST FLAG TRANSMITTER FREQUENCY f_4
TIME
P_1 TELL THE COMPUTER IT GOT THE REPLY (STEP 140)
P_1 PERMISSION SIGNAL (STEP 136)
P_1 REQUESTING TO SEND (STEP 214)
COMPUTER TELLS P_1 HAD RECEIVED THE MESSAGE (STEP 140)
P_2 TELLS THE COMPUTER THAT IT GOT THE MESSAGE (STEP 220)
GIVE P_2 PERMISSION TO SEND (STEP 136)
P_2 REQUEST TO TRANSMIT (STEP 214)
COMPUTER SENDING MESSAGE TO P_2(STEP 140)
P_1 SENDING MESSAGE TO COMPUTER (STEP 220)
GIVE P_1 PERMISSION TO TRANSMIT (STEP 136)
P_1 REQUEST TO TRANSMIT (STEP 214)

FIG. 7

CENTRAL OFFICE LAYOUT

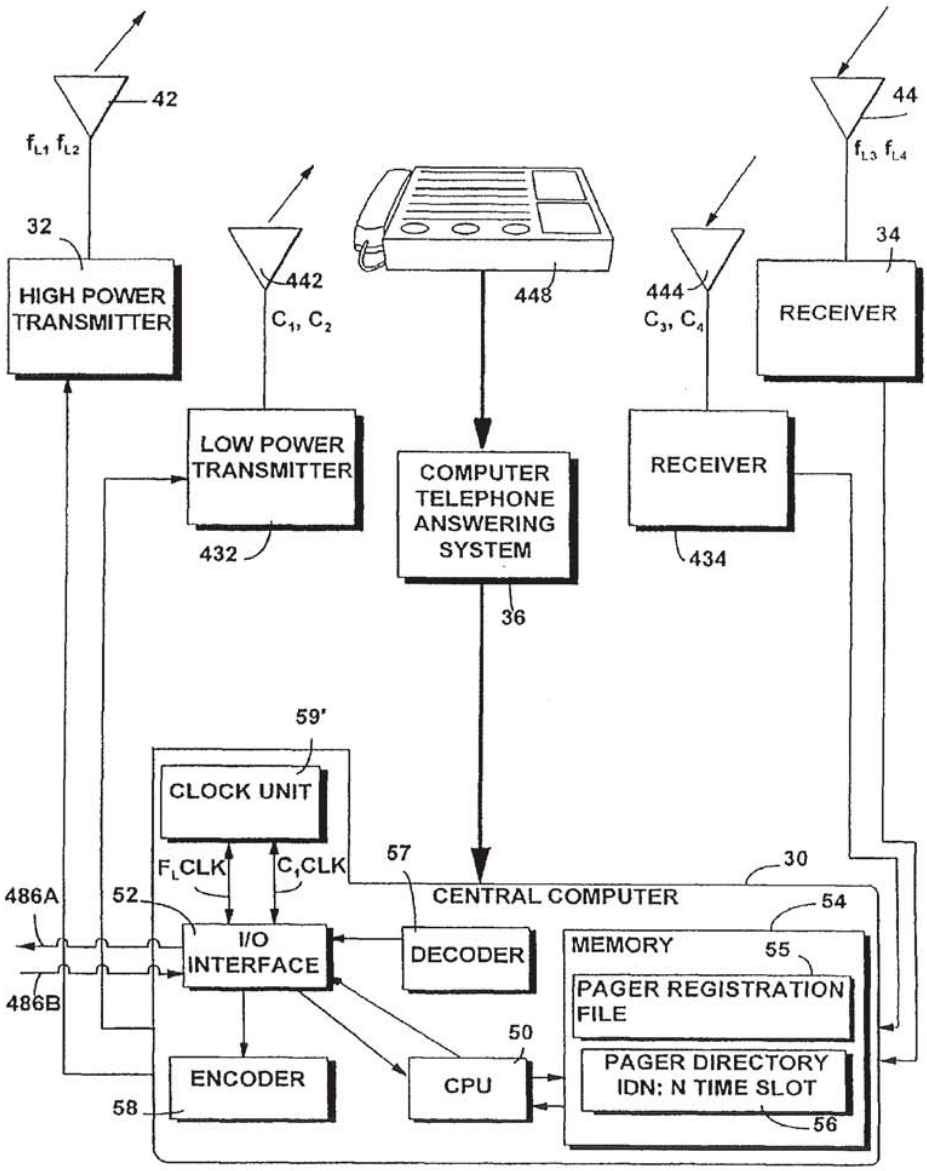


FIG. 8

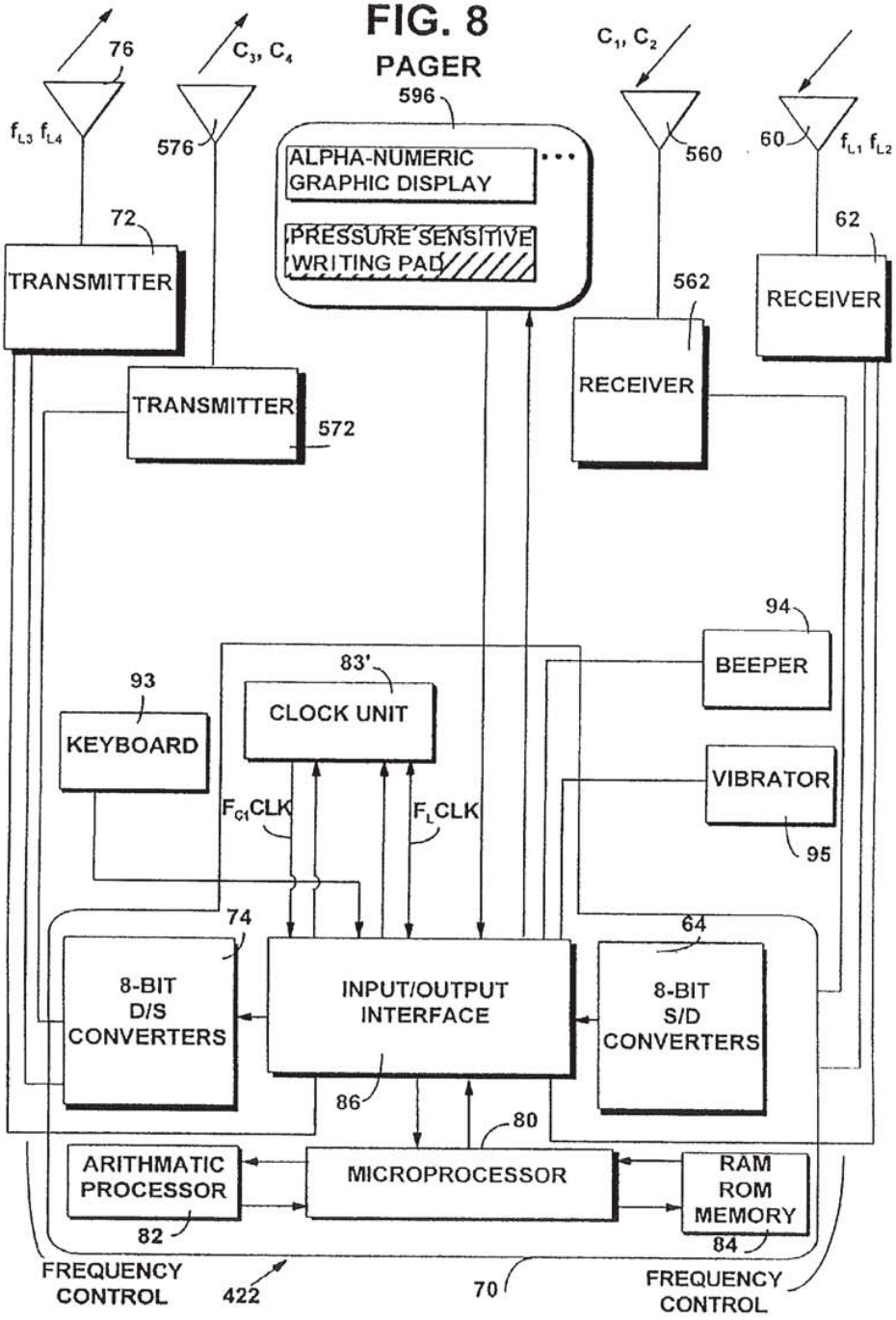
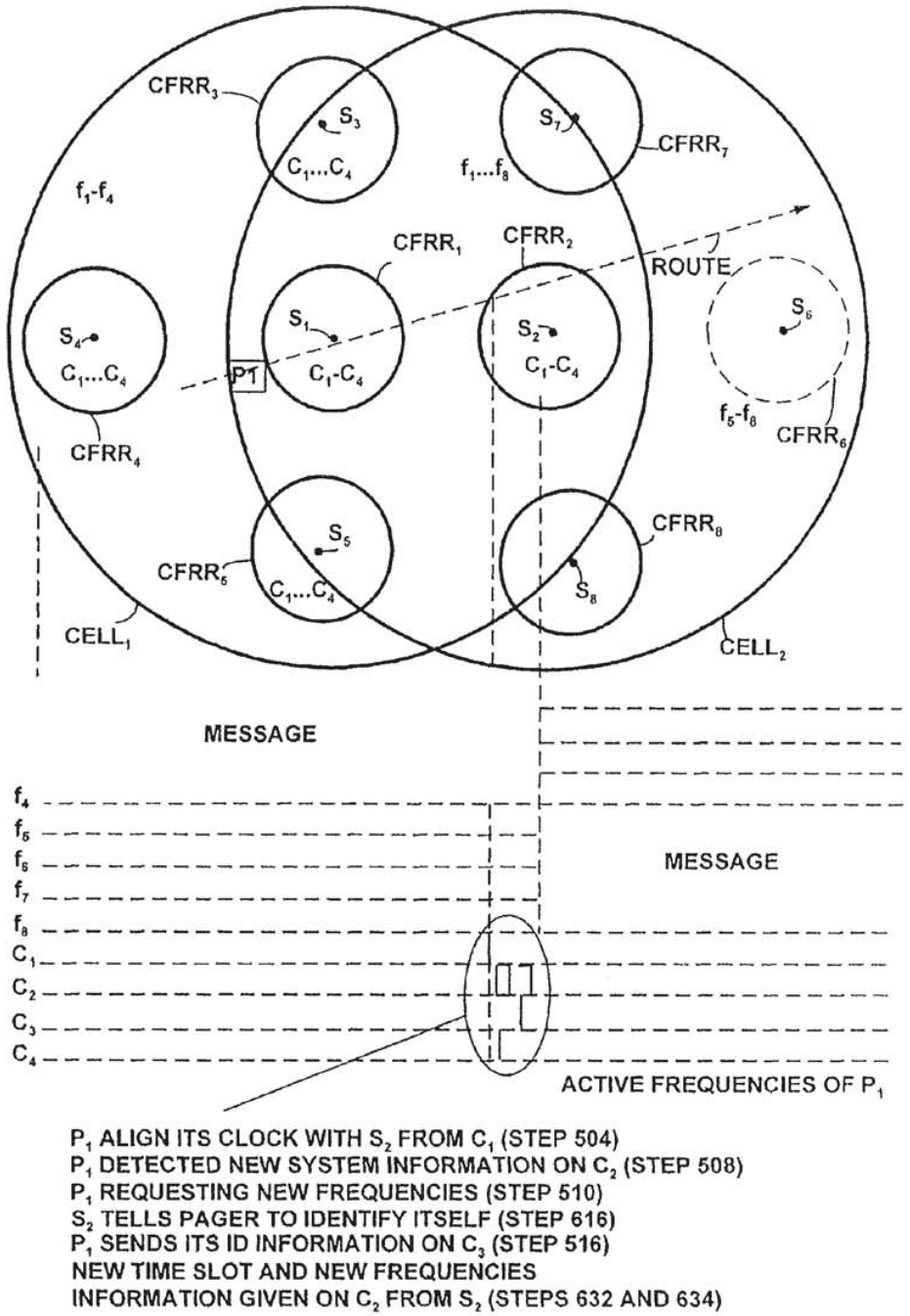

PAGER
596
ALPHA-NUMERIC GRAPHIC DISPLAY
PRESSURE SENSITIVE WRITING PAD
76
f_{L3} f_{L4}
72
TRANSMITTER
C_3, C_4
576
TRANSMITTER
572
C_1, C_2
560
562
RECEIVER
60
f_{L1} f_{L2}
62
RECEIVER
94
BEEPER
83'
CLOCK UNIT
93
KEYBOARD
VIBRATOR
95
F_{C1}CLK
F_LCLK
74
8-BIT D/S CONVERTERS
INPUT/OUTPUT INTERFACE
64
8-BIT S/D CONVERTERS
86
80
ARITHMATIC PROCESSOR
MICROPROCESSOR
RAM ROM MEMORY
82
84
FREQUENCY CONTROL
422
70
FREQUENCY CONTROL

FIG. 9



P1 ALIGN ITS CLOCK WITH S2 FROM C1 (STEP 504)
P1 DETECTED NEW SYSTEM INFORMATION ON C2 (STEP 508)
P1 REQUESTING NEW FREQUENCIES (STEP 510)
S2 TELLS PAGER TO IDENTIFY ITSELF (STEP 616)
P1 SENDS ITS ID INFORMATION ON C3 (STEP 516)
NEW TIME SLOT AND NEW FREQUENCIES
INFORMATION GIVEN ON C2 FROM S2 (STEPS 632 AND 634)

PAGER CHANNEL SWITCHING FLOW CHART

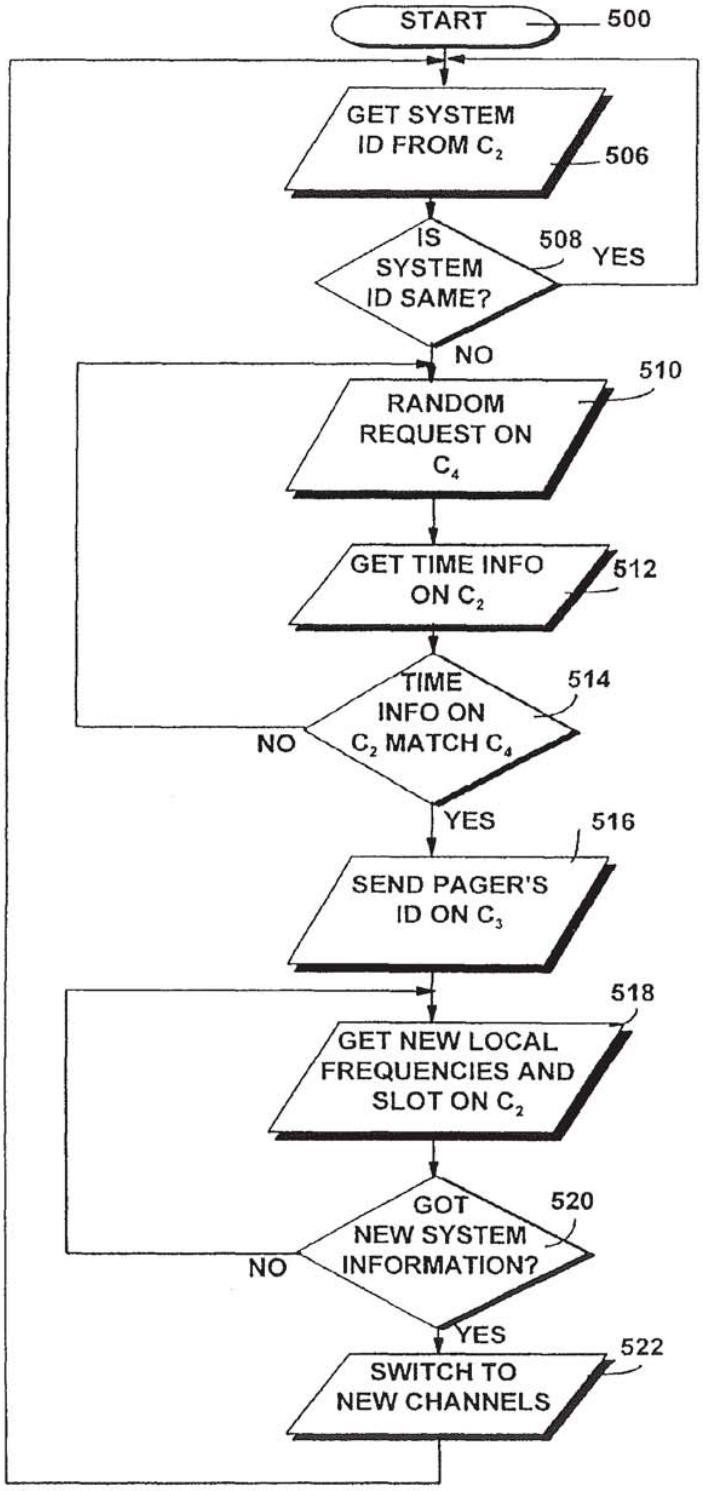
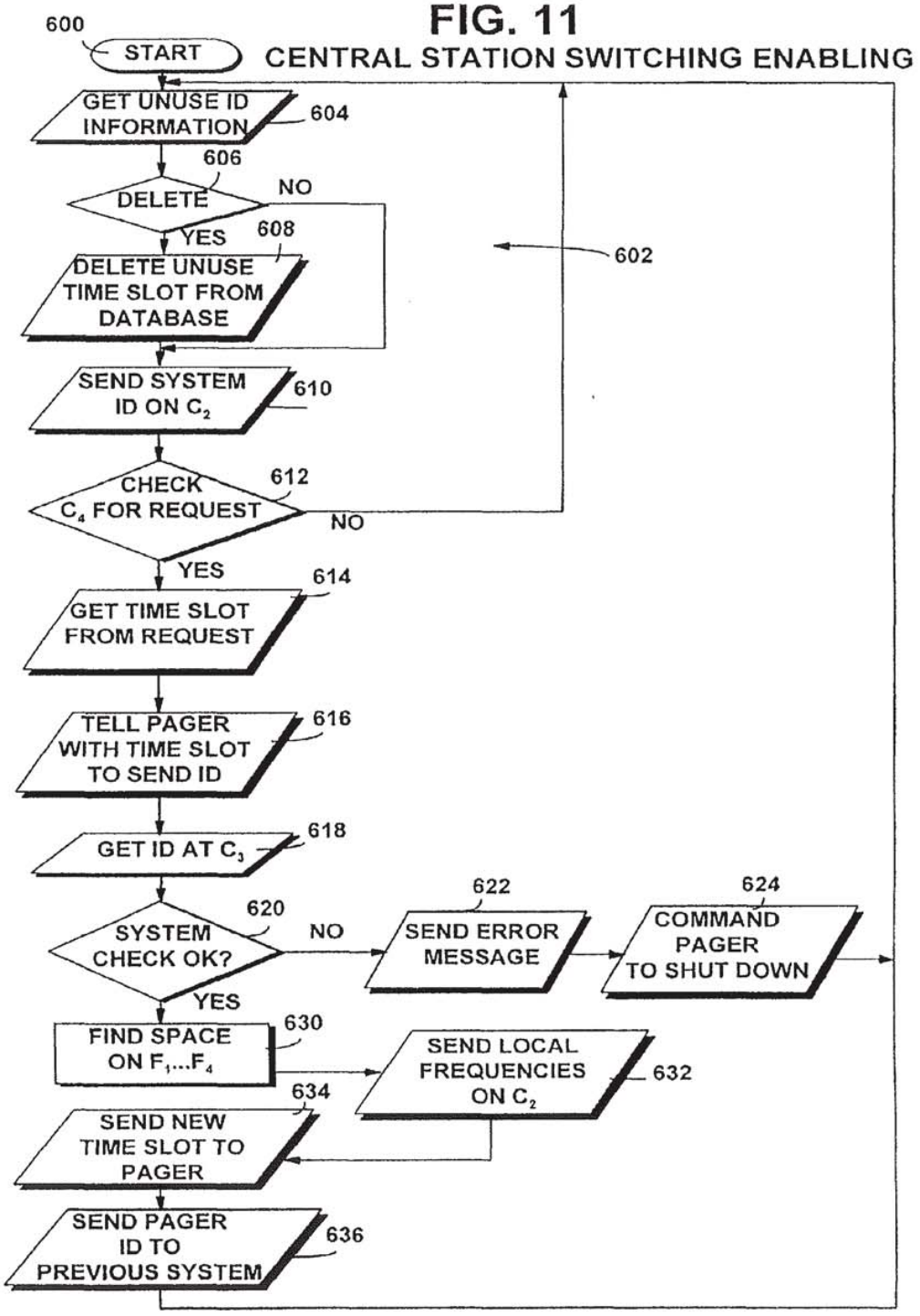


FIG. 10

FIG. 11
CENTRAL STATION SWITCHING ENABLING



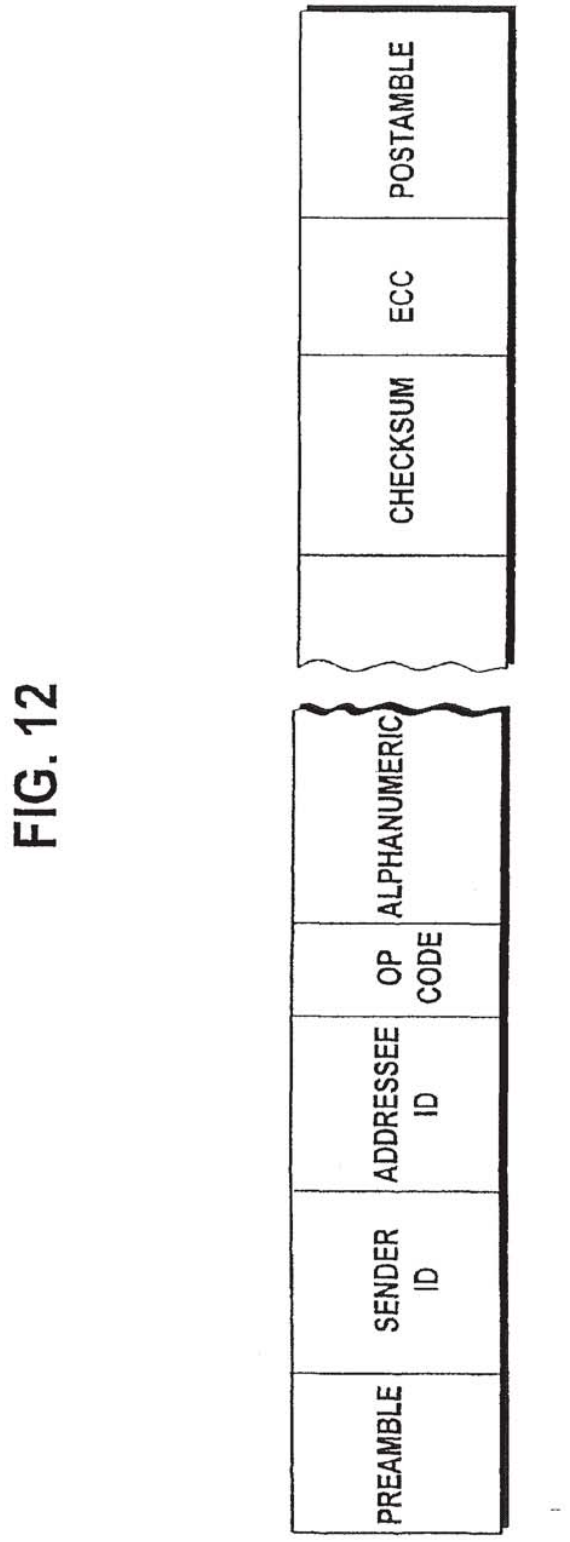
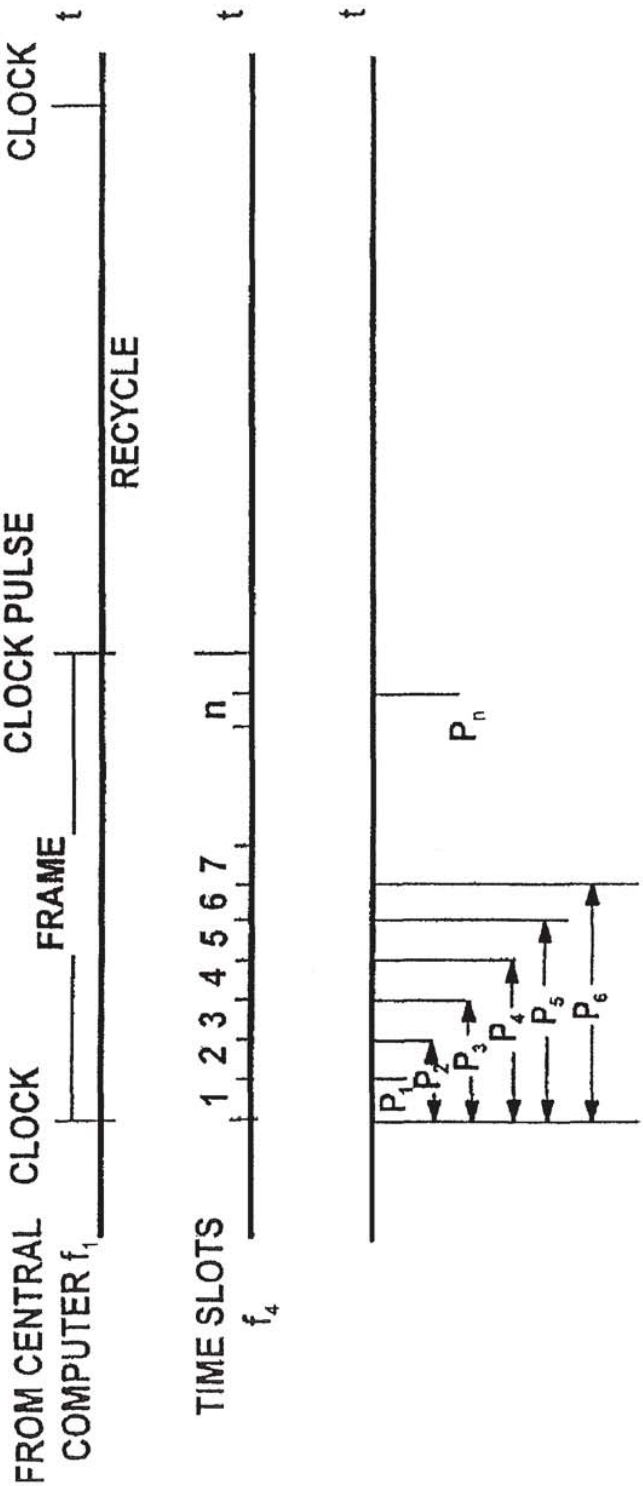

PREAMBLE
SENDER ID
ADDRESSEE ID
OP CODE
ALPHANUMERIC
CHECKSUM
ECC
POSTAMBLE

FIG. 12

FIG. 13


FROM CENTRAL COMPUTER
CLOCK
CLOCK PULSE
FRAME
RECYCLE
TIME SLOTS
1 2 3 4 5 6 7
n
t
f_1
f_4
P_1
P_2
P_3
P_4
P_5
P_6
P_n

NETWORK COMMUNICATION SYSTEM WITH AN ALIGNMENT SIGNAL TO ALLOW A CONTROLLER TO PROVIDE MESSAGES TO NODES AND TRANSMISSION OF THE MESSAGES OVER FOUR INDEPENDENT FREQUENCIES

CLAIM OF PRIORITY

This application is a continuation of U.S. patent application Ser. No. 11/668,922 filed on Jan. 30, 2007, which is a continuation of U.S. patent application Ser. No. 11/350,616 filed on Feb. 8, 2006, now U.S. Pat. No. 7,200,406, issued Apr. 3, 2007, which is a continuation of U.S. patent application Ser. No. 09/847,005 filed on May 2, 2001, now U.S. Pat. No. 7,031,716, issued Apr. 18, 2006, which is a continuation of U.S. patent application Ser. No. 09/594,662 filed on Jun. 15, 2000, now U.S. Pat. No. 6,282,406, issued Aug. 28, 2001, which is a continuation of U.S. patent application Ser. No. 09/259,417, filed on Dec. 9, 1997, now U.S. Pat. No. 6,108, 520, issued Aug. 22, 2000, which is a continuation of U.S. patent application Ser. No. 08/608,629 filed on Feb. 29, 1996, now U.S. Pat. No. 5,729,827, issued Mar. 17, 1998, which is a divisional of U.S. patent application Ser. No. 08/264,973, filed Jun. 24, 1994, now U.S. Pat. No. 5,542,115, issued Jul. 30, 1996, entitled "PAGING METHOD AND APPARATUS," naming Wong, et al. as inventors, all of these applications being incorporated by reference herein in their entirety.

BACKGROUND

1. Technical Field

This invention pertains to communications paging, and particularly to two-way paging method and apparatus.

2. Related Art

Over the last several decades, pagers have proven to be important communication devices for contacting remotely situated personnel. Whereas primitive pagers provided primarily only a tonal and/or vibratory output, more modern pagers have enhanced output capabilities such as message-bearing alphanumeric displays.

Paging systems have historically been one-way systems. That is, the user receives a paging message from a central terminal but has no way of responding to that message with the pager. Prior art attempts to provide two-way communication capabilities for a pager have included efforts to connect the pager to a telephone (e.g., to a mobile radio telephone). See, for example, U.S. Pat. No. RE 33,417 to Bhagat, et al. (which combines an entire radio pager and radiotelephone linked through an automatic dialer) and U.S. Pat. No. 5,117, 449 to Metroka, et. al. (which purports to combine paging and cellular radiotelephone functions in a single unit).

Some pagers have the capability of providing an acknowledgment or response to a paging signal. In some such "ack-back" systems, a user operates a reply input device (e.g., a toggle switch, pushbutton switch, or keyboard) when paged. Typically such ack-back systems involve a complex acknowledgement transmission scheme, involving numerous frequencies or frequency sub-bands. Hand-off of the pager, as the pager travels between differing geographic regions or "cells" served by differing central stations, becomes technically cumbersome when multitudinous frequencies are involved.

SUMMARY

A two-way paging system utilizes four local frequencies for transmissions between pager units and a central control station. A first local frequency carries a local clock; a second local frequency carries communications packets from the central control station to paging units; a third local frequency carries communication packets from the pager units to the central control station; and a fourth local frequency carries a status or request signal from the paging units to the central control station. Transmissions on the fourth local frequency are in accordance with a time divided slot allocation among pager units accessing the central control station.

For a two-way paging system having a plurality of central control stations servicing a corresponding plurality of cells, a total of eight frequencies are utilized within any one cell. Four of the utilized frequencies are the local frequencies (which may differ from cell to cell), and four of the utilized frequencies are lower power common frequencies or switching frequencies which are used to switch or hand-off a pager unit traveling from one cell to another.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. **1** is a schematic view of a central control station included in a paging system of an embodiment of the invention.

FIG. **2** is a schematic view of a pager unit included in a paging system for use with the central control station of FIG. **1**.

FIG. **3** is a flowchart depicting steps executed by the central control station of FIG. **1**.

FIG. **4** is a flowchart depicting steps executed by the pager unit of FIG. **2** when in a transmit mode.

FIG. **5** is a flowchart depicting steps executed by the pager unit of FIG. **2** when in a receive mode.

FIG. **6** is a timing diagram reflecting communications between the central control station of FIG. **1** and the pager unit of FIG. **2**.

FIG. **7** is a schematic view of a central control station included in a paging system of a second embodiment of the invention.

FIG. **8** is a schematic view of a pager unit included in a paging system for use with the central control station of FIG. **7**.

FIG. **9** is a hybrid schematic view and timing diagram for representing switching operations for the paging system of the second embodiment of the invention.

FIG. **10** is a flowchart depicting steps executed by the pager unit of FIG. **8** in connection with a channel switching operation.

FIG. **11** is a flowchart depicting steps executed by the central control station of FIG. **7** in connection with a channel switching operation.

FIG. **12** is a schematic view of a format of a communications packet utilized with embodiments of the invention.

FIG. **13** is a schematic view illustrating a time divided slot allocation technique according to the invention.

DETAILED DESCRIPTION

FIG. **1** shows a central control station **20** according to a first embodiment of the invention; FIG. **2** shows a paging unit **22** suitable for use with central control station **20**.

As shown in FIG. **1**, central control station **20** includes central computer **30**; transmitter **32**; receiver **34**; and computerized telephone answering system **36**. Transmitter **32** transmits, via transmitting antenna **42**, two local frequencies, namely frequency f_1 and frequency f_2. Receiver **34** is connected to receiver antenna **44** for reception of two local frequencies, namely frequency f_3 and frequency f_4. Computerized telephone answering system **36** is connected to a bank of telephones **48**.

Central computer **30** of central control station **20** comprises a conventional computer equipped with typical components including a CPU **50**; I/O interface **52**; and memory **54**. Although shown only generally in FIG. **1**, it should be understood that memory **54** includes a number of unillustrated memory devices, including (for example) a hard disk drive, RAM, and ROM. FIG. **1** shows that memory **54** has stored therein (among other things) a pager registration file **55** and a pager directory file **56**. Pager files **55** and **56** are typically stored on a hard disk drive of central computer **30**, and upon start-up are loadable into a RAM portion of memory **54**.

Central computer **30** of central control station **20** further includes a decoder **57** (connected between receiver **34** and I/O interface **52** for decoding in-coming communications information from one or more pager units **22**), as well as encoder **58** (connected between I/O interface **52** and transmitter **32** for encoding out-going communications information).

Central control station **20** also includes a clock unit **59** which generates a local clock signal $f_1$clk (which, in turn, is used to modulate frequency f_1).

As illustrated further herein, CPU **50** of central control station **20** prepares communications packets for transmission on frequency f_2. As generally illustrated in FIG. **12**, the communications packets are of a predetermined format, having fields for identification of the central control station, for identification of the addressed pager unit(s) **22**, for an operation code, for (optionally) alphanumeric information, and for other conventional packet-type information such as checksum, error correction, and postamble. The preamble and postamble are specially chosen patterns which can be recognized and distinguished from data for the purpose of determining the beginning and ending of a packet. The alphanumeric information can be in a customary binary 8-bit format. The format of FIG. **12** is illustrative only, as such information as the order of the fields can be varied in other embodiments.

Central control station **20** communicates with a plurality of pager units 22_1, 22_2, . . . 22_N. Only one such pager unit, generically referenced as pager unit **22**, is specifically illustrated and described herein, it being understood that the construction and operation of other pager units may be similar to the one illustrated.

As shown in FIG. **2**, pager unit **22** includes a pager receiver antenna **60** which is connected to pager receiver **62**. Pager receiver **62** is, in turn, connected through S/D converter **64** within pager computer **70**. Receiver **62** receives the two local frequencies f_1, and f_2, which frequencies have been modulated to carry in-coming communications information (described in more detail below) to pager computer **70**. On a communications output side, pager computer **70** outputs out-going communications information to pager transmitter **72** via D/S converter **74**. Transmitter **72** broadcasts, on pager antenna **76**, the out-going communications information on the two local frequencies f_3 and f_4.

As also shown in FIG. **2**, pager computer **70** includes pager microprocessor **80** which is connected to each of an arithmetic processor; a memory system **84** (including both ROM and RAM); and I/O interface **86**. I/O interface **86** is connected to a clock unit **87**. I/O interface **86** is also connected to receive

in-coming decoded communications information from an 8-bit decoder **88** and to output out-going uncoded communications information to an 8-bit encoder **90**. Decoder **88** is connected to receive in-coming coded communications information from S/D converter **64**; encoder **90** is connected to output out-going coded communications information to D/S converter **74**.

Clock unit **87** is settable by suitable inputs thereto so that clock unit **87** generates a local clock signal $f_1$clk having a frequency corresponding to its input. It should be understood that, in other embodiments, the function of clock unit **87** can be performed at least partially by microprocessor **80** using programmed execution.

I/O interface **86** is also connected to supply an on/off signal on line **92** to pager transmitter **72**, as well as to facilitate input and output with numerous input/output devices. The input/output devices connected to I/O interface **86** include keyboard **93**; beeper **94**; vibrator **95**; and LCD (alphanumeric) display **96**.

Upon manufacture, pager unit **22** is preprogrammed with an identification serial number (e.g., a 7-digit alphanumeric pre-assigned ID number) which is stored in memory **84** (ROM). Pager unit **22** is activated (e.g., at the time of purchase) by inserting a time slot assignment (explained below) both into a predetermined address in memory **84** of pager unit **22** and into pager directory file **56** (stored in memory **54** of central control station **20**).

Operation of First Embodiment

Communication between central control station **20** and pager unit **22** occurs on the four local frequencies, in particular the frequencies f_1, f_2, f_3, and f_4 mentioned above. The first frequency (f_1) carries the local clock-aligning signal from central control station **20** to paging unit **22**. The second frequency (f_2) carries a pager command and alphanumeric data from central control station **20** to paging unit **22**. The third frequency (f_3) carries pager status data and alphanumeric data from paging unit **22** to central control station **20**. The fourth frequency (f_4) carries a pager request signal from paging unit **22** to central control station **20**. In the illustrated embodiment, the frequencies f_1-f_4 are preferably chosen so that $f_1 \neq f_2 \neq f_3 \neq f_4$.

As explained in more detail below and illustrated in FIG. **13**, in normal non-cell-switching operation, the pager request signal on frequency f_4 is transmitted in a predetermined time slot assigned to paging unit **22**. The predetermined time slot on frequency f_4 is related to the clock-aligning signal (carried by frequency f_1) and assigned whereby the fourth frequency is utilizable by a plurality of other paging units. For example, as shown in FIG. **13**, a first time slot on frequency f_4 is assigned to a pager P**1**; a second time slot is assigned to pager P**2**, and so on up to time slot n assigned to pager Pn. In the illustrated embodiment, the number of time slots (and accordingly the number of pagers) may be as many as ten thousand or more.

FIG. **3** shows steps executed by CPU **50** of central control station **20** in processing communications to and from one or more paging units. The steps depicted in FIG. **3** are indicative of instructions stored in a ROM portion of memory **54** of central control station **20**.

When central control station **20** is started up (step **100**), an initialization process (step **102**) is conducted. Included in the initialization process is activation of transmitter **32** (so that transmitter **32** can transmit at the two frequencies f_1 and f_2) and activation of receiver **34** (so that receiver **34** can receive the two frequencies f_3 and f_4). Moreover, frequency f_1 is

modulated to carry the local clock-aligning signal generated by local clock **59**. Then, at step **104**, the pager registration file **55** and the pager directory file **56** are loaded from hard disk into a RAM section of memory **54** (step **104**).

After initialization and loading of the files **55** and **56**, CPU **50** repetitively executes an instruction loop **106**. Loop **106** involves checking to determine (at step **108**) whether a telephone message is being received (via answering system **36** from one of the telephones in bank **48**) and checking to determine (at step **110**) whether a pager message is being received (via transmitter **32** from one of the pager units **22**).

As used herein, a message, whether originated from a telephone or from a pager, may require a plurality of packets for transmission from a central station **20** to a pager **22** or vice versa. In the ensuing discussion, transmission and reception of messages subsumes transmission and reception of one or more packets. In general, the packetization of messages will be invisible to the user, meaning that a user enters a message without regard to the number of packets which might be required to transmit the message. The message typically ends with a user-entered message termination character or message delimiter character. The transmitting device (either central station **20** or pager **22**), allocates the message to one or more packets having a format similar to that of FIG. **12**, with the last packet in the message bearing the message termination character. Alternatively, the packets may be formatted in a manner to indicate the number of consecutively related packets emanating from a transmitter (e.g., there may be a separate packet field indicating the continuation number of related packets).

Central computer **30** can distinguish between receipt of a telephone message (at step **108**) and a pager message (at step **110**) by virtue of the fact that I/O interface **52** generates different types of interrupts to CPU **50** depending on the type of message received. If it is determined at step **108** that a telephone message is being received, steps **112**, **114**, and **116** of FIG. **3** are executed.

In processing a received telephone message, at step **112** central computer **30** extracts out-going communications information from the predeterminately sequenced telephone-entered data. The telephone-entered data, entered via a touch-pad of a calling one of the telephones in bank **48**, includes by convention an identification (e.g., telephone number) of the calling telephone; an identification of the called pager unit (e.g., the 7-digit alphanumeric pre-assigned ID number); and any character data for transmission followed by a termination character. This out-going communications information is received at central computer **30** in standard DTMF format.

At step **114**, using the ID number of the called pager (obtained at step **112**) central computer **30** checks the pager registration file **55** and directory file **56** to determine whether the called pager unit is registered with central control station **20**. Assuming that the called pager is so registered, at step **114** the central computer **30** also obtains from pager directory file **56** the slot assignment for the called pager unit.

At step **116**, central control station **30** transmits communications information to the called pager unit. In this regard, central control station **20** prepares and transmits (on frequency f_2) a communications message which includes, among other things, the ID of the called pager unit and the character data received from the telephone for transmission of the pager unit **22**. After step **116** is executed, processing returns to loop **106**.

If it is determined at step **110** that a pager message is being received, even numbered steps **132-140** of FIG. **3** are executed (prior to returning to loop **106**). As will be seen hereinafter with respect to FIG. **4**, a sending pager unit **22** transmits, in its assigned time slot, a request signal on frequency f_4 when the sending pager unit **22** desires to send a message. As central control station **20** is always monitoring frequency f_4, a request signal carried by frequency f_4 from any pager unit **22** is noted. With reference to the local clock **59**, at step **132** CPU **50** determines in what time slot on frequency f_4 the request signal is detected. Upon detection of the time slot at step **132**, at step **134** CPU **50** consults the pager directory file **56** to determine the identification number of the particular pager unit **22** which originated the request signal.

With the identity of the requesting pager unit **22** now known, at step **136** central control station **20** authorizes the requesting pager unit **22** to transmit its message. In particular, CPU **50** directs preparation of a communications message for transmission on frequency f_2. The particular communications packet prepared at step **136** includes an identification of the requesting pager unit (the addressee of the packet), as well as an operation code ("op" code) which commands/authorizes the requesting pager unit **22** to send its message.

At step **138**, central control station **20** receives a communications message on frequency f_3 sent from the sending (e.g., requesting) pager unit **22**. The communications message prepared and sent by the sending pager unit **22** includes packets of similar format to that shown in FIG. **12**, and includes an identification of a pager to which the message is ultimately addressed as well as its own identification. At step **138**, CPU **50** checks to ensure that the ultimate addressee pager unit is registered in pager files **55** and **56**. At step **140**, CPU **50** makes any necessary reformatting and/or information substitution in the message, and causes the message to be transmitted on frequency f_2. The transmission on frequency f_2 required by step **140** includes the identification of the ultimate addressee (e.g., a pager unit **22**) as well as an operation code indicating that the transmission includes a relayed message from another pager unit.

Steps executed by a pager unit **22** in connection with its transmission mode are depicted in FIG. **4**. Steps executed by a pager unit **22** in connection with its receive mode are depicted in FIG. **5**. The term "mode" as used herein does not connote exclusivity at any particular moment, for it should be remembered that at all times pager unit **22** is receiving transmissions on frequencies f_1 and f_2.

In its transmission mode (see FIG. **4**), after start-up (step **200**) microprocessor **80** of the transmitting pager unit **22** executes a loop **202** wherein user alphanumeric characters (entered via keyboard **93**) are repetitively fetched (at step **204**) until an end of message delimiter is detected (at step **206**). As entered, the characters fetched at step **204** are displayed on LCD display **96**. Entry of the delimiter character at step **206** causes microprocessor **80** to exit loop **202**. By convention, the message must include an addressee ID, which addressee ID is likely the ID of another one of the pager units to which the message entered in step **204** is directed.

After entry of the message awaits entry from keyboard **93** of a transmit command at step **212**. Assuming that the transmit command is entered at step **212**, microprocessor **80** prepares and sends a request signal on frequency f_4. As indicated before, the request signal is transmitted on frequency f_4 in a time slot assigned to the requesting pager unit **22**. It should be kept in mind that pager unit **22** is all the while receiving the local clock-aligning signal on frequency f_1, which enables microprocessor **80** to cause transmission of the request signal on frequency f_4 at a time corresponding to the specific time slot allotted to the particular sending pager unit **22**.

In the above regard, in accordance with time division techniques, each pager unit 22_1-22_N (e.g., pagers P1-PN in FIG. **13**) is assigned a selected one of N number of time slots on frequency f_4.

After transmission of the request signal at step **214**, pager unit **22** awaits receipt of a transmit command from central control station **20**. Preparation and transmission of the transmit command/authorization from central control station **20** is described with reference to FIG. **3**. Upon receipt of the transmit command/authorization from central control station **20** (step **216**), microprocessor **80** prepares (at step **218**) a communications message with one or more packets having a format much like that of FIG. **12**. The addressee ID and alphanumeric field of packets of the communications message is filled with the message entered in loop **202**. At step **220**, the sending pager unit **22** broadcasts the communications packet on frequency f_3.

If a transmit command is not entered at step **212**, or after transmission of the message at step **220**, microprocessor **80** awaits entry of at least one of several possible special function keys at step **222**. For example, the user may press a function key which requires storage of the message (whether yet transmitted or not) [see step **228**]. Alternatively, the user may press function keys which facilitate editing or erasure of the message (see steps **224** and **226**, respectively). To complete the message and begin work on another message, a special function key for an exit operation (step **230**) must be pressed.

FIG. **5** depicts steps executed by microprocessor **80** of pager unit **22** when in a receive mode. After start-up (step **302**), and as indicated by step **304**, pager unit **22** receives transmissions from central control station **20** on frequency f_2. Once a complete packet is received (determined at step **306**), a check is made (at step **308**) whether the addressee ID in the communications packet (see packet format of FIG. **12**) is the ID of the receiving pager unit **22**. If the determinations of either step **306** or **308** are negative, pager unit **22** awaits either completion of the communications packet (in the case of step **306**) or receipt of another communications packet (in the case of step **308**) by looping back to step **304**.

Assuming that the received communications packet is designated for this particular receiving pager unit **22**, at step **310** microprocessor **80** consults the operation code field of the communications packet (see FIG. **12**) to determine if the operation code indicates that the message includes a command. If the operation code indicates a command, a command processing routine (framed by broken lines **312** in FIG. **5**) is executed.

Assuming for the moment that the operation code does not indicate a command, at step **314** microprocessor **80** of pager unit **22** stores the alphanumeric field portion of the communications packet (which at least partially forms the message) in a RAM portion of memory **84**. Since a message communicated from central processing station **20** may require several communications packets for completion of the message (with subsequent communication packets providing continuations of the message content), microprocessor **80** checks at step **316** to ensure that the entire message has been received. If not, processing continues back at step **304** for reception of a further communications packet.

Upon reception of an entire communications message, at step **318** microprocessor **80** determines whether pager unit **22** is in a beep mode or a vibrate mode. In this regard, there are numerous ways of setting paging unit **22** to the desired mode, either by a specially dedicated switch on paging unit **22** or by data entry using keyboard **93**. If pager unit **22** is in a beep mode, microprocessor **80** outputs a signal which causes I/O interface **86** to issue a further signal to activate beeper **94** (step **320**). Alternatively, if pager unit **22** is in a vibrate mode, microprocessor **80** outputs a signal which causes I/O interface **86** to issue a further signal to activate vibrator **95** (step **322**).

At step **324**, microprocessor **80** directs I/O interface **86** to send the alphanumeric message data to LCD display **96**, so that the received message can be viewed by the user.

After notification to the user (either via beeper **94** and/or vibrator **95**), and display (on LCD **96**) of the received alphanumeric data, microprocessor **80** returns to step **304** to check whether further communications packets are being received.

The command processing routine (framed by broken lines **312** in FIG. **5**) first determines (step **330**) which particular operation is being commanded. This determination is based on the content of the operation code, which is different for different command types. If the operation code indicates an error shut-down, execution jumps to an error shut-down sub-routine which begins at step **340**. If the operation code indicates a time slot change, execution jumps to a change time slot sub-routine which begins at step **350**. If the operation code requires transmitter shut-down, execution jumps to a transmitter shut-down sub-routine which begins at step **360**. If the operation code requires transmitter re-enablement, execution jumps to a transmitter reenable sub-routine which begins at step **370**. If the operation code requires clock re-set, execution jumps to a clock re-set sub routine which begins at step **380**.

In connection with the error shut down sub-routine, at step **342** microprocessor **80** obtains an indication of error type from the communications packet. The error type is stored in memory **84** (step **344**) and then displayed on LCD display **96** (step **346**). Then microprocessor **80** issues a command (at step **348**) to shut down pager unit **22**, which shut-down occurs at step **349**.

In connection with the time slot changing sub-routine, at step **352** microprocessor **80** extracts, from the received communications packet, information indicative of the new time slot assigned to the receiving pager unit **22**. The new time slot is entered (at step **354**) into memory **84** and thereafter utilized (until further change) in connection with transmission of request signals on frequency f_4 (see, for example, step **214** of FIG. **4**).

The time slot changing sub-routine may also include other operations, if desired, including (for example) eliminating unused time slots (thereby increasing scanning rate); diagnosing and trouble shooting; and avoiding interruption of service from malfunctioning or ill-functioning equipment.

In connection with the transmitter shut down sub-routine, at step **362** microprocessor **80** directs I/O interface **86** to issue an OFF command to transmitter **72**. In connection with the transmitter re-enable sub-routine, at step **372** microprocessor **80** directs I/O interface **86** to issue an ON command to transmitter **72**.

In connection with the clock re-set sub-routine, at step **382** microprocessor **80** directs that clock **59** of pager unit **22** be set.

After execution of steps **354**, **362**, **372**, or **382**, execution continues back to step **304** for processing of potential further communications packets. Thus, unless an error shut-down is noted, each entry of the command processing routine (framed by broken lines **312** in FIG. **5**) is followed by a loop back to step **304**.

FIG. **6** is a timing diagram showing the frequencies f_1-f_4 and integration of the steps depicted in FIGS. **3**-**5**, particularly in the context of a request by a sending pager unit P1 for sending a message to a sendee pager unit P2. As employed in FIG. **6**, "computer" refers to central control station **20**. It should be understood that the sending pager unit P1 and the

sendee pager unit P2 operate in both the transmission mode as depicted in FIG. **4** and in the receiver mode as depicted in FIG. **5**. In general, FIG. **6** shows transmission of a message from pager unit P1 (via central control station **20**) to pager unit P2; transmission of a confirmation message from pager unit P2 (via central control station **20**) to pager unit P1; and transmission of a message from pager unit P1 to central control station **20** indicating that pager unit P1 received the confirmation message from pager unit P2.

Structure of Second Embodiment

FIG. **7** shows a central control station **420** according to a second embodiment of the invention; FIG. **8** shows a paging unit **422** suitable for use with central control station **420**.

FIG. **9** shows a wide area paging system including a plurality of central control stations S1-S8 (each identical to central control station **420**), each preferably geographically centered within a respective cell. Each central control station S1-S8 broadcasts its own local frequencies, as well as a set of common or switching frequencies C_1-C_4. The common frequencies C_1-C_4 are broadcast at a lower power, so that reception thereof occurs only in a relatively small neighborhood or common frequency reception region (CFRR) [also referred to as a "switching region"] about the central control station. The local frequencies are broadcast at a significantly greater power for reception substantially throughout the cell. For example, in FIG. **9**, central control station S1 broadcasts its lower power common frequencies C_1-C_4 to $CFRR_1$ and its higher power local frequencies f_1-f_4 to $CELL_1$; central control station S2 broadcasts its lower power common frequencies C_1-C_4 to $CFRR_2$ and its higher power local frequencies f_5-f_8 to $CELL_2$.

As also shown in FIG. **9**, $CELL_1$ and $CELL_2$ overlap in an overlap region shown in FIG. **9**. Station S1 utilizes a set of local frequencies f_1-f_4; station S2 utilizes a different set of local frequencies f_5-f_8. Both stations S1 and S2 utilize the same set of common or switching frequencies C_1-C_4. Thus, each central control station utilizes two sets of frequencies, there being four frequencies in each set, resulting in a total of eight frequencies handled per station.

Thus, the second embodiment of the invention is suitable for a system having a plurality of central control stations 420_x where x=1, 2, . . . M. Each central control station 420_x transmits and receives a set of local frequencies f_{L1}, f_{L2}, f_{L3}, f_{L4} in an associated geographical area or cell, as well as the set of common or switch frequencies C_1, C_2, C_3, C_4. While the values of the local frequencies f_{L1}, f_{L2}, f_{L3}, f_{L4}, vary from cell to cell (e.g., differ for differing central control stations 420_x), the values of the common or switch frequencies C_1, C_2, C_3, C_4 are uniform through the system (e.g., for all central control stations 420_x).

Although not shown in FIG. **9**, it should be understood that the pattern of central control stations repeats in like manner in all compass directions in accordance with the prescribed geographical boundaries of the paging system. Moreover, although not specifically illustrated in FIG. **9**, it should also be understood that each central control station **420** has an associated CFRR.

The common or switching frequencies C_1-C_4 have an analogous function to the corresponding local frequencies f_1-f_4, respectively. In this regard, frequency C_1 carries a clock frequency transmitted by central control station(s), although the clock rate on common frequency C_1 preferably varies among central control stations. Frequency C_2 is used to transmit information from central control station(s) to pager unit(s); frequency C_3 is used to transmit information from a pager unit to a central control station; frequency C_4 is used by pager units to issue a request signal. Frequency C_2 carries packets having a format similar to that of FIG. **12**. In analogous manner to frequency f_2, the packets carried by frequency C_2 may have command codes. Among the C_2 command codes are a SYSTEM COMMAND CODE; a LOCAL FREQUENCY DOWNLOAD COMMAND CODE; a SLOT RECOGNITION COMMAND CODE; and a SLOT ASSIGNMENT COMMAND CODE.

As shown in FIG. **7**, central control station **420** resembles central control station **20** of the embodiment of FIG. **1** (similar components being assigned the same reference numerals for simplicity). However, central control station **420** is augmented by inclusion of a further transmitter, known as common frequency transmitter **432**, together with its common frequency transmission antenna **442**, for transmitting the common frequencies C_1 and C_2. In contrast to the high power transmitter **32**, transmitter **432** is a low power transmitter. Further, central control station **420** is augmented by inclusion of a further receiver, known as the common frequency receiver **434**, together with its common frequency receiver antenna **444**, for reception of the common frequencies C_3 and C_4.

Central control station **420** of FIG. **7** includes a clock unit **59'** which generates two clocking signals—a first or local clocking signal $f_L$clk and a second or common clocking signal C_1clk. The local clocking signal $f_L$clk is used to modulate frequency f_1; the common clocking signal is used to modulate the common frequency C_1.

The central computers **30** of the central control stations 420_x are serially connected to one another by an output line **486**A and an input line **486**B. In particular, although not expressly shown as such in FIG. **7**, computer **30** of FIG. **7** (like that of FIG. **1**) includes an I/O interface to which the serial lines **486**A and **486**B are connected. Serial lines **486**A and **486**B are used, for example, to update contents of the pager registration file **55** and the pager directory file **56**.

As shown in FIG. **8**, pager unit **422** resembles pager unit **22** of the embodiment of FIG. **2** (similar components again being assigned the same reference numerals for simplicity). However, pager unit **422** (in like manner as central control station **420**) is augmented by inclusion of a further transmitter, known as common frequency transmitter **572**, together with its common frequency transmission antenna **576**, for transmitting the common frequencies C_3 and C_4. Further, central control station **420** is augmented by inclusion of a further receiver, known as the common frequency receiver **434**, together with its common frequency receiver antenna **444**, for reception of the common frequencies C_1 and C_2.

The operational frequencies of transmitter **72** and receiver **62** are changeable in accordance with values transmitted on "frequency control" lines from computer **70**. In particular, the frequency control lines are connected to I/O interface **86** in computer **70**. As described in more detail below, when a pager unit **422** migrates into a new CFRR, signals are applied on the frequency control lines in order to switch pager unit **422** from the local frequencies of an old cell to the local frequencies of a new cell associated with the new CFRR into which pager unit **422** migrates.

Pager **422** includes a clock unit **83'** which is capable of separately generating local clocking signals $f_L$clk and the common clocking signals $f_c$clk for use by microprocessor **80**. These clocking signals are initiated and their frequencies set by appropriate respective inputs to clock unit **83'**.

FIG. **8** also shows that pager unit **422** has data I/O unit **596** which includes both an alphanumeric graphic display and a pressure sensitive writing pad. The alphanumeric graphic

display is a dot matrix device which can display characters and graphics. The writing pad has a 16×48 dot area.

Operation of Second Embodiment

As shown in FIG. **9**, a pager unit P1 is assumed to have been operating in $CELL_1$ and to have previously received the common frequencies C_1-C_4 and local frequencies f_1-f_2 from station S1. Now pager unit P1 travels on a route indicated by broken arrow-headed line ROUTE. In traveling along the ROUTE, pager unit P1 continues to operate on local frequencies f_1-f_2, even as it travels through the cellular overlap region. However, when pager unit P1 enters a new common frequency reception region (i.e., $CFRR_2$), a switching or hand-off operation occurs. In the switching operation, as explained in more detail below, pager unit P1 obtains common frequencies C_1-C_4 from central control station S2 and, as a result, can switch from the local frequencies f_1-f_4 of $CELL_1$ to the local frequencies f_5-f_8 of $CELL_2$. In order to effect the switching or hand-off operation, pager unit P1 executes a channel switching routine; the central control station S2 executes a switching enabling routine.

In connection with the channel switching routine and the switching enabling routine, when pager unit P1 moves into $CFRR_2$, pager unit P1 will receive the clocking signal on frequency C_1 from station S2. At such point, pager unit P1 will automatically align its clock unit with the clocking signal from station S2.

Referring now to the channel switching routine executed by pager P1 subsequent to start-up (step **500**), at step **506** pager unit P1 obtains information characterizing the system centered about station S2. Such characterizing information is referred to as system identification or system ID information.

At step **508**, microprocessor **80** of pager unit P1 checks to determine if there is any new system ID information acquired on frequency C_2. That is, microprocessor **80** checks to determine if system ID information is received on frequency C_2 (which can occur only in a CFRR) and, if so, compares the system ID information to the immediately previously-stored system ID information. If the previous and most recently-acquired system IDs are the same, pager unit P1 realizes that it is still in the jurisdiction of the same station (e.g., station S1). If not, pager unit P1 realizes that it has now wandered into a CFRR of a new station (e.g., station S2) and, at step **510**, initiates a request on frequency C_4 for communication with the central control station (e.g., station S2) for $CELL_2$.

In the above regard, since pager unit P1 has not yet been assigned a time slot for $CELL_2$, the request on frequency C_4 is randomly made. However, pager unit P1 keeps track of the time slot in which it makes its request to the new central control station (e.g., station S2).

Thereafter, pager unit P1 continues to monitor (step **512**) communications packets from station S2 on frequency C_2, waiting for station S2 to issue a message which references the time slot at which pager unit P1 made its request of step **510**. In particular, pager unit P1 awaits a message from station S2 on frequency C_2 that includes both a SLOT RECOGNITION COMMAND CODE and information stored in the same time slot which pager unit P1 randomly generated. Since the message including the SLOT RECOGNITION COMMAND CODE includes station S2 as the sender and mirrors the slot randomly generated by pager unit P1, pager unit P1 recognizes the message as being addressed to pager unit P1 and considers issuance of such a message by station S2 (see step **612** of FIG. **11**) to constitute authority for pager unit P1 to communicate further with station S2. In this regard, at step **514** microprocessor **80** of pager unit P1 determines if there is a match between the time slot of a received message and the time slot at which the random request was made at step **510**.

Assuming a match is eventually found at step **514**, at step **516** pager unit P1 sends a communications packet on frequency C_3 to station S2, with the communications packet including the identification or ID of pager unit P1. Using pager registration file **55**, station S2 verifies that the ID of pager unit P1 is a valid ID, and thereafter sends (on frequency C_2) to pager unit P1 a message with the command code LOCAL FREQUENCY DOWNLOAD, which message informs pager unit P1 of the values of the local frequencies handled by station S2 (e.g., frequencies f_5-f_8). Thereafter, as also reflected by step **518**, station S2 sends (on frequency C_2) to pager unit P1 a message with the command code SLOT ASSIGNMENT COMMAND CODE, which message informs pager unit P1 of its slot assignment on frequency f_8. Microprocessor **80** then changes its slot allocation by steps which are similar to those discussed with the afore-mentioned change time slot routine (see steps **350**, **352**, and **354** of FIG. **5**). Step **518** of FIG. **10** reflects reception of the local frequency values and reception of the slot assignment.

After acquisition of all local frequencies and the slot assignment is completed (step **520**), microprocessor **80** implements (at step **522**) a switch to the new local frequencies (e.g., frequencies f_5-f_8). In this regard, microprocessor **80** instructs I/O interface **86** to change transmitter **72** from frequencies f_3, f_4 to frequencies f_7, f_8; and to change receiver **62** from frequencies f_1, f_2 to frequencies f_5, f_6. I/O interface **86** accomplishes the frequency changes by applying appropriate values on the frequency control lines connecting the I/O interface to transmitter **72** and receiver **62**, respectively.

After the switch to new local frequencies at step **522**, microprocessor **80** loops back to step **506**, ultimately to determine when any further switching may be required.

Steps involved in the switching enabling routine executed by a central control station (e.g., station S2) are depicted in FIG. **11**. After start-up (step **600**), CPU **50** executes a loop **602** which enables CPU **50** to clean up its pager directory file **56** and to check if any new pager units have wandered into the cell which it administers.

In particular, at step **604** CPU determines whether its central control station (e.g., S2) has been advised by any other central control station (e.g., S3) that a pager unit, formerly under the control of its central control station (e.g., S2), has come under the control of the other central control station (e.g, S3). Such advisement occurs on the serial links connecting the central control stations 420_x, and particularly input serial link **486**B. If such advisement occurs, the ID for the wandered-away pager is deleted from the pager directory file **56** for station S2 (as reflected by steps **606** and **608**).

At step **610**, CPU **50** causes messages with a SYSTEM COMMAND CODE to be transmitted on frequency C_2. As indicated before, messages transmitted on frequency C_2 include a packet(s) having a format such as that shown in FIG. **12**. The message with the SYSTEM COMMAND CODE particularly includes the central station ID number in its alphanumeric data field.

At step **612**, central control station **420** checks to determine if a request signal has been transmitted by any pager unit **422** on frequency C_4 (as occurred, for example, in context of the discussion of FIG. **10**, particularly step **510**). Such a request signal would likely be issued from a pager unit **422** which has just wandered into the CFRR controlled by the central control station (e.g., into $CFRR_2$ controlled by station S2). If no such request signal is detected, loop **602** is again repeated.

In the event that a request signal is detected at step **612**, central control station **420** notes specifically the time slot on

frequency C_4 at which the request occurred (step **614**). At this point, such time slot is the only way central control station **420** can identify the in-wandering pager unit **422**. Central control station **420** desires for the in-wandering pager unit **422** to transmit its identification (ID), but cannot specifically address the in-wandering pager other than with reference to the detected time slot. Accordingly, at step **616**, central control station **420** prepares and transmits a message on frequency C_2 which has a SLOT RECOGNITION COMMAND CODE. The message including the SLOT RECOGNITION COMMAND CODE includes station S2 as the sender and mirrors the slot randomly generated by pager unit P1 (e.g, the time slot at which the in-wandering pager unit **422** issued its request). This transmission on frequency C_2 constitutes authority for pager unit P1 to transmit its identification.

Step **618** denotes acquisition by central control station **420** of the identification (ID) of the in-wandering pager unit **422**. At step **620**, central control station **420** checks its pager registration file **55** to determine if the pager ID is a valid ID. If not, an error message is generated and transmitted (at step **622**), followed by a command for pager unit P1 to shut down (see step **624**).

Assuming that the identification of pager unit **422** was validated at step **620**, CPU **50** checks (at step **630**) its pager directory file **56** to locate an available time slot for the in-wandering pager unit **422**, and then associates the available time slot with the ID of the in-wandering pager unit **422**. Then, at step **632**, using a message on frequency C_2 with a LOCAL FREQUENCY DOWNLOAD COMMAND CODE, central control station **420** sends the values of its local frequencies (e.g., f_5, f_6, f_7, f_8) to the in-wandering pager unit **422**. The central control station then (at step **634**) assigns to the in-wandering pager unit **422** a new time slot on its local frequencies using a message on frequency C_2 with a SLOT ASSIGNMENT COMMAND CODE. Processing of the change time slot command by the in-wandering pager unit **422** is understood with analogous reference to FIG. **5**, particularly steps **350**, **352**, and **354**.

Upon completion of step **634**, the in-wandering pager unit **422** is fully initiated into its new cell (e.g., $CELL_2$), and has left the jurisdiction of its former control station (e.g, $CELL_1$ and station S1). Accordingly, at step **636**, CPU **50** requests its I/O interface to issue a command on serial line **486**A which advises (using pager ID) that the in-wandering pager **422** is now under its jurisdiction, so that former jurisdictions (e.g., S1) can delete this pager unit from their pager directory files **56**. Such deletion is understood with reference to steps **604**-**608** as above-described.

In addition to illustrating geographical location of pager P1, stations S1 and S2, and cells $CELL_1$ and $CELL_2$, FIG. **9** shows the relative timing of communications occurring on common frequencies C_1-C_4. FIG. **9** specifically relates the timing of communications transmissions to specific ones of the aforedescribed steps executed by central control station **420** (the switching enabling routine of FIG. **11**) and by pager unit **422** (the channel switching routine of FIG. **10**).

Although the central control stations 420_x use the same common frequencies C_1-C_4, there is no interference or confusion of these signals transmitted from the control stations 420_x. The common frequencies C_1-C_4 are broadcast at a relatively lower power than the local frequencies f_1-f_4 so that reception of the common frequencies C_1-C_4 occurs only in a limited neighborhood (CFRR) about the central control station 420_x. Accordingly, pager units **422** traveling through the system receive common frequencies C_1-C_4 only in the limited and non-overlapping CFRRs.

System operational characteristics, such as cell diameter, CFRR diameter, power level of the local frequencies (e.g., f_1-f_4), and power level of the common frequencies (C_1-C_4) can be field adjusted to suit numerous factors, including particularly the terrain and topography of the geographical region covered by the system. By way of non-limiting example, in one embodiment, the radius of each cell is on the order of about 20 miles; while the radius of each CFRR is on the order of about 10 miles or less. In the same example, the power for transmission of the local frequencies can be in a range of from about 3 watts to 1000 watts; while the power for transmission of the common frequencies C_1-C_4 is preferably less than 2 watts.

Thus, the invention provides a two-way paging system which operates independently from a telephone system for wireless data communication between users. The invention minimizes use of available frequencies allowed by the Federal Communications Commission (FCC), using only four local frequencies f_1-f_4 for any given cell and (for expanded, multi-cellular coverage) only four common or switching frequencies C_1-C_4. In order to minimize the number of frequencies (e.g, channels) utilized, techniques of time division sharing and synchronization are employed. A transmission power differential between the local frequencies and the common frequencies is also employed. These techniques allow data transmission to be kept separate from different pagers and thus eliminate merging of data.

The switching technique of the present invention provides extended geographical coverage and minimizes paging time by increasing the number of frequencies utilized in a cell from four (e.g, the four local frequencies) to eight (the four local frequencies plus the four common frequencies).

In connection with verification of pager ID, it should be understood that a single pager registration file might be stored in a memory file of only one of a plurality of central control stations, and that in such case verification would constitute issuing a search command (on the serial links **486**) to locate a pager ID in the one (remote) memory file, with the results of the search being reported back to the inquiring central control station.

The keyboards illustrated herein can, in some embodiments, be multi-language keyboards or writing pads which permit typing of English, Chinese, or Japanese languages, for example. The writing pad is especially useful in countries such as Japan, Thailand, the Middle East or China where English-like alphabets are not used. The writing pad could also be used to sketch and transmit graphics. Moreover, data compression/de-compression techniques can be utilized in connection with data transfer.

While the invention has been particularly shown and described with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that various alterations in form and detail may be made therein without departing from the spirit and scope of the invention. For example, it should be understood that repeaters may be employed within cells to facilitate transmission when a pager unit ventures far from a central control station.

What is claimed:

1. A method of operating a data communication system, the data communication system including at least a first communication controller and at least a first node, the method comprising:

transmitting a random access connection request signal from the first node to the first communication controller in a first slot indicating that the first node can receive messages transmitted from the first communication controller;

receiving a connection request response signal from the first communication controller transmitted to the first node in response to the random access connection request signal, said connection request response signal providing information indicating that the first node can transmit a reserve access request signal in a second slot in order to subsequently transmit a message to the first communication controller;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmitting the reserve access request signal in the first slot in response to the connection request response signal from the first communication controller;

receiving a grant signal from the first communication controller subsequent to transmission of the reserve access request signal, said grant signal including information indicating resources have been allocated for transmission of message data packets to the first communication controller;

transmitting the message data packets from the first node in response to the grant signal;

wherein the message data packets comprise multiple data packets, wherein at least one the message data packets contain information related to a count value, wherein the final data packet from the multiple data packets contains terminal indication information indicating that termination of the message data packets has occurred;

wherein a subsequent reserve access request signal from a second node provided in a third slot assigned to the second node can be transmitted during transmission of the message data packets by the first node; and

wherein the aligning signal is received on first frequency, the reserve access request signal is transmitted on a second frequency, the grant signal is received on a third frequency and the message data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

2. A first node in a data network, the data network including a plurality of nodes including the first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface configured by the at least one processor to:

transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;

receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmit the reserve access request signal in the second slot in response to the first grant signal;

receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an allocation of additional resources for transmitting the data packets;

transmit the data packets in response to the second grant signal,

wherein a subsequent request signal by a second node into a third slot assigned to the second node can be transmitted during transmission of the data packets by the first node; and

wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

3. The first node of claim **2**, wherein the data packets comprise multiple data packets, wherein at least one of the data packets comprise information related to a count value, wherein a final data packet from the multiple data packets comprise terminal indication information indicating that the final data packet is a last data packet.

4. The first node of claim **3**,

wherein the first grant signal returns randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal.

5. The first node of claim **4**, wherein the first node further comprises a touch sensitive display input device.

6. The first node of claim **2**,

wherein the random access request signal transmitted from the first node includes randomly generated information created by the first node,

wherein the first grant signal returns said randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal.

7. The first node of claim **6**, wherein subscriber identification is transmitted from the first node subsequent to the first node receiving return of said randomly generated information.

8. The first node of claim **6**, wherein the second slot is assigned to the first node independent of the randomly generated information.

9. The first node of claim **6**, wherein the data packets comprise multiple data packets, wherein at least one of the data packets comprise information related to a count value,

wherein a final data packet from the multiple data packets comprise terminal indication information indicating that the final data packet is a last data packet.

10. The first node of claim **2**,

wherein the availability of said second slot to the first node recurs in repeated transmissions until a communication controller disables use of the second slot by the first node; and

wherein the data packets are transmitted in at least one slot separate from the recurring second slot.

11. A controller in a network including a plurality of nodes, the controller comprising:

at least one processor;

a memory providing code to the at least one processor; and

at least one interface configured by the at least one processor to:

receive a random access request signal transmitted by a first node in the plurality of nodes in a first slot, the random access request signal including information that allows the controller to determine that the first

node requires an allocation of resources to transmit a reserve access request signal;

transmit a first grant signal subsequent to receipt of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

transmit an aligning signal which enables the first node to transmit the reserve access request signal;

receive the reserve access request signal from the first node subsequent to transmission of the first grant signal;

transmit a second grant signal subsequent to receipt of the reserve access request signal from the first node, said second grant signal including information related to an allocation of additional resources to the first node for transmitting the data packets;

receiving the data packets from the first node subsequent to transmission of the second grant signal;

wherein the aligning signal is transmitted on a first frequency, the reserve access request signal is received on a second frequency, the second grant signal is transmitted on a third frequency and the data packets are received on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal; and

wherein reception of a subsequent request signal from a second node is provided in a third slot is received during reception of the data packets from the first node.

12. The controller of claim **11**, wherein the interface is further configured to:

receive information relating to a count value to enable the processor of the controller to determine when the data packets being transmitted are completely received; and

receive information relating to terminal indication information indicating that a final data packet from the data packets is a last data packet.

13. The controller of claim **12**,

wherein the random access request signal transmitted from the first node includes randomly generated information created by the first node,

wherein the first grant signal returns said randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal.

14. The controller of claim **12**, wherein the availability of said second slot to the first node recurs in repeated transmissions until the controller disables use of the second slot by the first node.

15. The controller of claim **14**, wherein each of the random access request signal, the first grant signal and the reserve access request signal are provided on differing frequencies.

16. A first node in a data network, the data network including a plurality of nodes, the first node comprising:

at least one processor;

a memory providing code to the processor; and

at least one interface configured by the processor to:

transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;

receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmit the reserve access request signal in the second slot subsequent to receiving the first grant signal;

receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an allocation of additional resources for transmitting the data packets;

transmit the data packets in response to the second grant signal,

wherein the interface further transmits information relating to a count value,

wherein the interface transmits terminal indication information indicating that the final data packet is a last data packet,

wherein a subsequent reserve access request signal from a second node provided in a third slot assigned to the second node can be transmitted during transmission of the data packets by the first node; and

wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

17. The first node of claim **16**, wherein the first node further comprises a touch sensitive display input device.

18. The first node of claim **16**,

wherein the availability of said second slot to the first node recurs in repeated transmissions until a communication controller in the plurality of nodes disables use of the second slot by the first node; and

wherein the data packets are transmitted in at least one slot separate from the recurring second slot.

19. A first node in a data network, the data network including a plurality of nodes including the first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface configured by the at least one processor to:

transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;

receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

transmit the reserve access request signal in the second slot in response to the first grant signal;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant

signal including information relating to an allocation of additional resources for transmitting the data packets; and

transmit the data packets in response to the second grant signal,

wherein the availability of said second slot to the first node recurs in repeated transmissions until a communication controller disables use of the second-slot by the first node, and

wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

20. The first node of claim **19**, wherein each of the random access request signal, first grant signal, and the reserve access request signal are provided on differing frequencies.

21. The first node of claim **19**, wherein a cell switching operation to change frequencies for transmission from the first node between a first communication controller and a second communication controller occurs at a time after transmission of all of the random access request signal, the reserve access request signal, the first grant signal, the second grant signal, and commencing the transmission of the data packets.

22. The first node of claim **19**, wherein the interface is further configured to:

transmit information relating to a number of related ones of the data packets being transmitted.

23. The first node of claim **19**,

wherein the data packets may include information related to a count value, and

wherein a final data packet from the data packets further comprise terminal indication information indicating that the final data packet is a last data packet.

24. The first node of claim **23**, wherein the first node further comprises a touch sensitive display input device.

25. The first node of claim **19**,

wherein the data packets are transmitted in at least one slot separate from the recurring second slot.

26. The first node of claim **19**, wherein the reserve access request signal by the first node into the second slot allocated to the first node can be transmitted during transmission of data packets by a second node, and

wherein said reserve access request signal transmitted by the first node is transmitted on a differing frequency than said data packets transmitted by the second node.

27. The first node of claim **26**, wherein a subsequent request signal by a third node into a third slot assigned to the third node can be transmitted during transmission of the data packets by the first node, and

wherein said subsequent request signal by the third node is transmitted on a differing frequency than said data packets by the first node.

28. A first node in a data network, the data network including a plurality of nodes including the first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface configured by the at least one processor to:

transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;

receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;

receive an aligning signal which enables the first node to transmit the reserve access request signal;

transmit the reserve access request signal in the second slot in response to the first grant signal;

receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information relating to an allocation of additional resources for transmitting the data packets;

transmit the data packets in response to the second grant signal,

wherein a subsequent request signal by a second node into a third slot assigned to the second node can be transmitted during transmission of the data packets by the first node;

wherein the subsequent request signal by the second node is provided in the third slot on a differing frequency from the data packets transmitted by the first node; and

wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

29. The first node of claim **28**, wherein the data packets comprise multiple data packets, wherein at least one of the data packets comprise information related to a count value, wherein a final data packet from the multiple data packets further comprise terminal indication information indicating that the final data packet is a last data packet.

30. The first node of claim **29**,

wherein the random access request signal transmitted from the first node includes randomly generated information created by the first node,

wherein the first grant signal returns said randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal.

31. The first node of claim **30**, wherein the first node further comprises a touch sensitive display input device.

32. The first node of claim **28**,

wherein the random access request signal transmitted from the first node includes randomly generated information created by the first node,

wherein the first grant signal returns said randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal.

33. The first node of claim **32**, wherein subscriber identification is transmitted from the first node subsequent to the first node receiving return of said randomly generated information.

34. The first node of claim **32**, wherein the second slot is assigned to the first node independent of the randomly generated information.

35. The first node of claim **32**, wherein the data packets may include information related to a count value.

36. The first node of claim 28,
wherein the availability of said second slot to the first node recurs in repeated transmissions until a communication controller disables use of the second slot by the first node; and
wherein the data packets are transmitted in at least one slot separate from the recurring second slot.

37. A first node in a data network, the data network including a plurality of nodes, the first node comprising:
at least one processor;
a memory providing code to the processor; and
at least one interface configured by the processor to:
transmit a random access request signal in a first slot, the random access request signal including information that allows determination that the first node requires an allocation of resources to transmit a reserve access request signal;
receive a first grant signal subsequent to transmission of the random access request signal, said first grant signal including information relating to an allocation of a second slot to the first node for transmitting the reserve access request signal for subsequently transmitting data packets containing a message;
receive an aligning signal which enables the first node to transmit the reserve access request signal;
transmit the reserve access request signal in the second slot subsequent to receiving the first grant signal;
receive a second grant signal subsequent to transmission of the reserve access request signal, said second grant signal including information related to an allocation of additional resources for transmitting the data packets;
transmit the data packets in response to the second grant signal,
wherein the first grant signal returns randomly generated information to the first node to enable identification of the first node as a desired recipient of the first grant signal;
wherein the interface further transmits information relating to a count value,
wherein the interface further transmits terminal indication information indicating that a final data packet is a last data packet; and
wherein the aligning signal is received on a first frequency, the reserve access request signal is transmitted on a second frequency, the second grant signal is received on a third frequency and the data packets are transmitted on a fourth frequency, wherein the first frequency, the second frequency, the third frequency and the fourth frequency are differing frequencies, wherein the aligning signal is distinct from the first grant signal.

38. The first node of claim 37, wherein the second slot is assigned to the first node independent of the randomly generated information.

39. The first node of claim 37, wherein subscriber identification is transmitted from the first node subsequent to the first node receiving return of said randomly generated information.

40. The first node of claim 37, wherein the first node further comprises a touch sensitive display input device.

41. The first node of claim 37, wherein the interface is further configured to receive the aligning signal with which the first node can synchronize signals.

42. The first node of claim 41, wherein the aligning signal with which the first node can synchronize signals defines a frame boundary.

43. The first node of claim 42, wherein said aligning signal further defines timeslots with the frame boundary.

44. The first node of claim 37,
wherein subsequent to transmission of the data packets, the first node receives a first acknowledgement on a downstream frequency, said first acknowledgement on the downstream frequency including information which informs the first node that the data packets have been received, and
wherein subsequent to receiving the first acknowledgement on the downstream frequency, the first node responds with a subsequent acknowledgement on a subsequent upstream frequency which acknowledges receipt of the first acknowledgement.

45. The first node of claim 37, wherein the third frequency may also carry downstream data packets to the plurality of nodes including the first node.

46. The first node of claim 37, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

47. The node of claim 37, wherein the second frequency remains allocated for further reserve access request signals while the first node is sending the data packets on the fourth frequency.

48. The first node of claim 47, wherein the first node further comprises a touch sensitive display input device.

49. The first node of claim 47, wherein the interface is further configured to receive the aligning signal with which the first node can synchronize signals.

50. The first node of claim 49, wherein the aligning signal with which the first node can synchronize signals defines a frame boundary.

51. The first node of claim 50, wherein said aligning signal further defines timeslots with the frame boundary.

52. The first node of claim 47,
wherein subsequent to transmission of the data packets, the first node receives a first acknowledgement on a downstream frequency, said first acknowledgement on the downstream frequency including information which informs the first node that the data packets have been received, and
wherein subsequent to receiving the first acknowledgement on the downstream frequency, the first node responds with a subsequent acknowledgement on a subsequent upstream frequency which acknowledges receipt of the first acknowledgement.

53. The first node of claim 47, wherein the third frequency may also carry downstream data packets to the plurality of nodes including the first node.

54. The first node of claim 47, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

55. The first node of claim 37, wherein a number of the differing frequencies for reserved slot operations allocated at any particular point in time for utilization by the first node is constant at four frequencies.

56. The first node of claim 55, wherein the second slot is assigned to the first node independent of the randomly generated information.

57. The first node of claim 55, wherein subscriber identification is transmitted from the first node subsequent to the first node receiving return of said randomly generated information.

58. The first node of claim 55, wherein the first node further comprises a touch sensitive display input device.

59. The first node of claim 55, wherein the interface is further configured to receive the aligning signal with which the first node can synchronize signals.

60. The first node of claim 59, wherein the aligning signal with which the first node can synchronize signals defines a frame boundary.

61. The first node of claim 60, wherein said aligning signal further defines timeslots with the frame boundary.

62. The first node of claim 55,

wherein subsequent to transmission of the data packets, the first node receives a first acknowledgement on a downstream frequency, said first acknowledgement on the downstream frequency including information which informs the first node that the data packets have been received, and

wherein subsequent to receiving the first acknowledgement on the downstream frequency, the first node responds with a subsequent acknowledgement on a subsequent upstream frequency which acknowledges receipt of the first acknowledgement.

63. The first node of claim 55, wherein the third frequency may also carry downstream data packets to the plurality of nodes including the first node.

64. The first node of claim 55, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

65. The node of claim 55, wherein the second frequency remains allocated for further requests while the first node is sending the data packets on the fourth frequency.

66. The node of claim 55, wherein the second frequency remains allocated for further reserve access request signals while the first node is sending the data packets on the fourth frequency.

67. The first node of claim 66, wherein the first node further comprises a touch sensitive display input device.

68. The first node of claim 66, wherein the interface is further configured to receive the aligning signal with which the first node can synchronize signals.

69. The first node of claim 68, wherein the aligning signal with which the first node can synchronize signals defines a frame boundary.

70. The first node of claim 69, wherein said aligning signal further defines timeslots with the frame boundary.

71. The first node of claim 66,

wherein subsequent to transmission of the data packets, the first node receives a first acknowledgement on a downstream frequency, said first acknowledgement on the downstream frequency including information which informs the first node that the data packets have been received, and

wherein subsequent to receiving the first acknowledgement on the downstream frequency, the first node responds with a subsequent acknowledgement on a subsequent upstream frequency which acknowledges receipt of the first acknowledgement.

72. The first node of claim 66, wherein the third frequency may also carry downstream data packets to the plurality of nodes including the first node.

73. The first node of claim 66, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

* * * * *

Exhibit 5

US007570954B2

(12) **United States Patent**
Wong et al.

(10) **Patent No.: US 7,570,954 B2**
(45) **Date of Patent: *Aug. 4, 2009**

(54) **COMMUNICATION SYSTEM WHEREIN A CLOCKING SIGNAL FROM A CONTROLLER, A REQUEST FROM A NODE, ACKNOWLEDGEMENT OF THE REQUEST, AND DATA TRANSFERRED FROM THE NODE ARE ALL PROVIDED ON DIFFERENT FREQUENCIES, ENABLING SIMULTANEOUS TRANSMISSION OF THESE SIGNALS**

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This patent is subject to a terminal disclaimer.

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(58) **Field of Classification Search** 370/319, 370/321, 322, 324, 330; 455/450, 509, 510, 455/516, 517

See application file for complete search history.

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(57) **ABSTRACT**

A communication system is provided for communication between network nodes and a communication controller. In the network, a request signal is transmitted from a first node to the communication controller when the first node has a packet data message to transmit. The communication controller then acknowledges the request, and the first node transmits its data message in response. The communication controller further transmits a clocking signal allowing synchronization of the node signals with the controller signals. The clocking signal, request, acknowledgement and data message can all be provided on different frequencies, allowing simultaneous transmission of these signals for efficient operation.

37 Claims, 13 Drawing Sheets

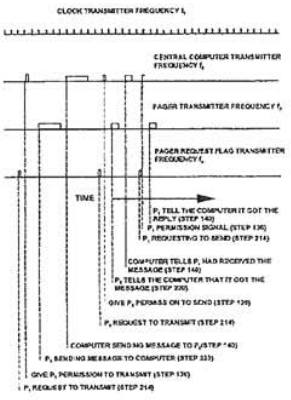

EXHIBIT B

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Exhibit A—Samsung Telecommunications America's First Supplemental Invalidity Contentions—Claim Chart—Mobitex Interface Specification (Mobitex) Against the Asserted Claim of the '406 Patent.

Exhibit B—Samsung Telecommunications America's First Supplemental Invalidity Contentions—Claim Chart—U.S. Patent No. 5,103,445 (Ostlund) Against the Asserted Claim of the '406 Patent.

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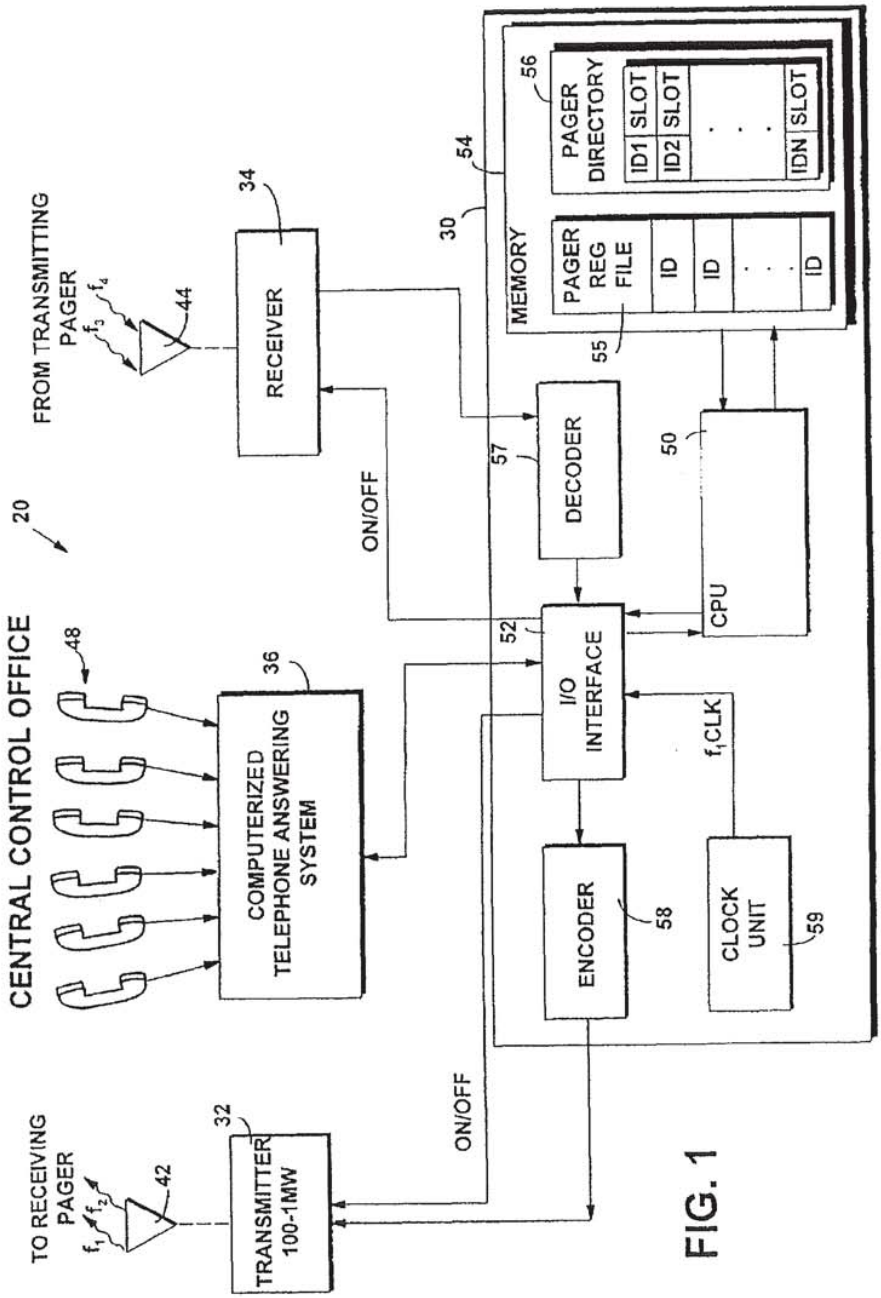

CENTRAL CONTROL OFFICE
20
FROM TRANSMITTING PAGER
f_3 f_4
44
RECEIVER
34
ON/OFF
30
MEMORY
54
PAGER DIRECTORY
56
ID1 SLOT
ID2 SLOT
IDN SLOT
PAGER REG FILE
55
ID
DECODER
57
50
CPU
48
COMPUTERIZED TELEPHONE ANSWERING SYSTEM
36
52
I/O INTERFACE
f_1CLK
ENCODER
58
CLOCK UNIT
59
TO RECEIVING PAGER
f_1 f_2
42
TRANSMITTER 100-1MW
32
ON/OFF

FIG. 1

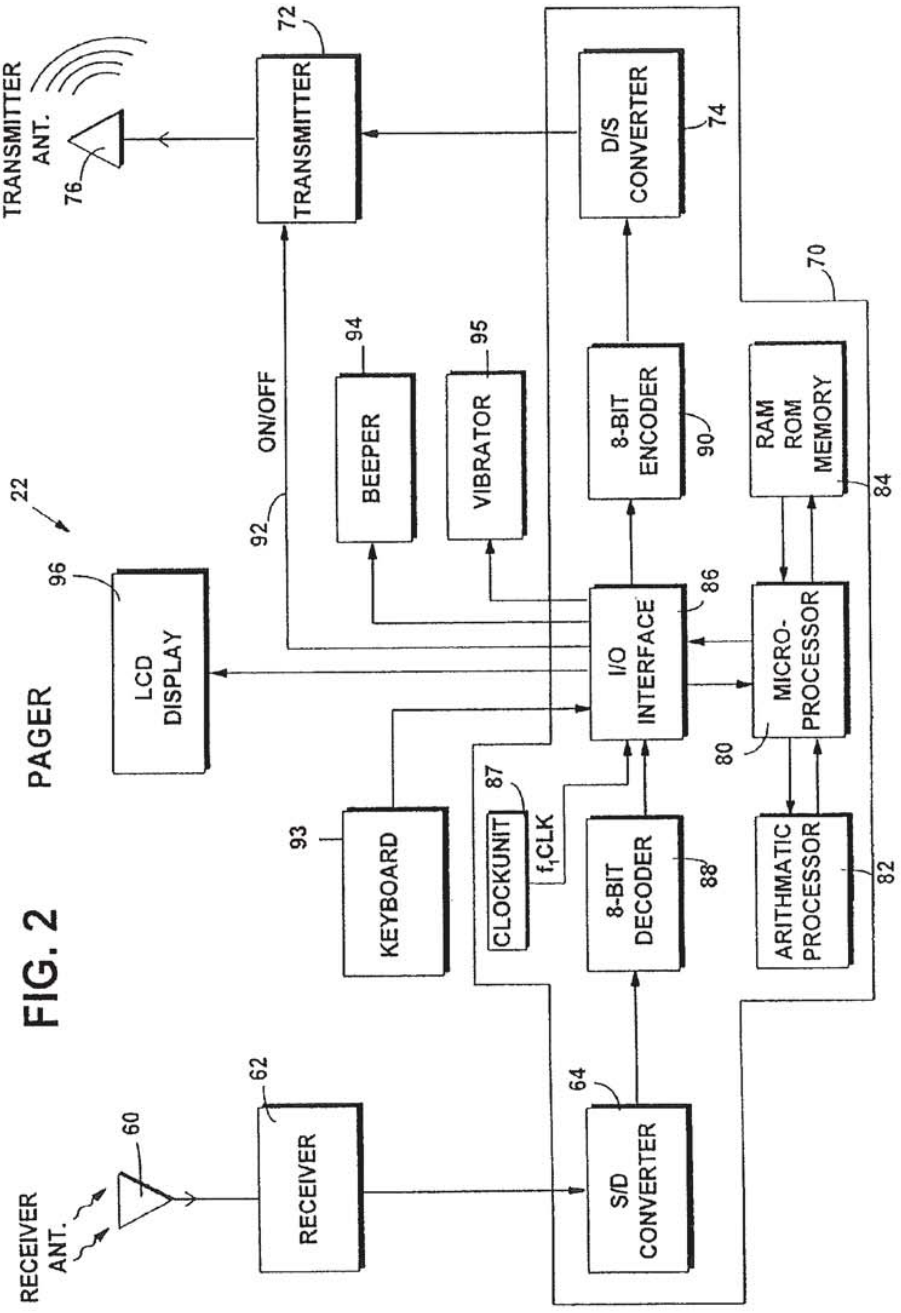
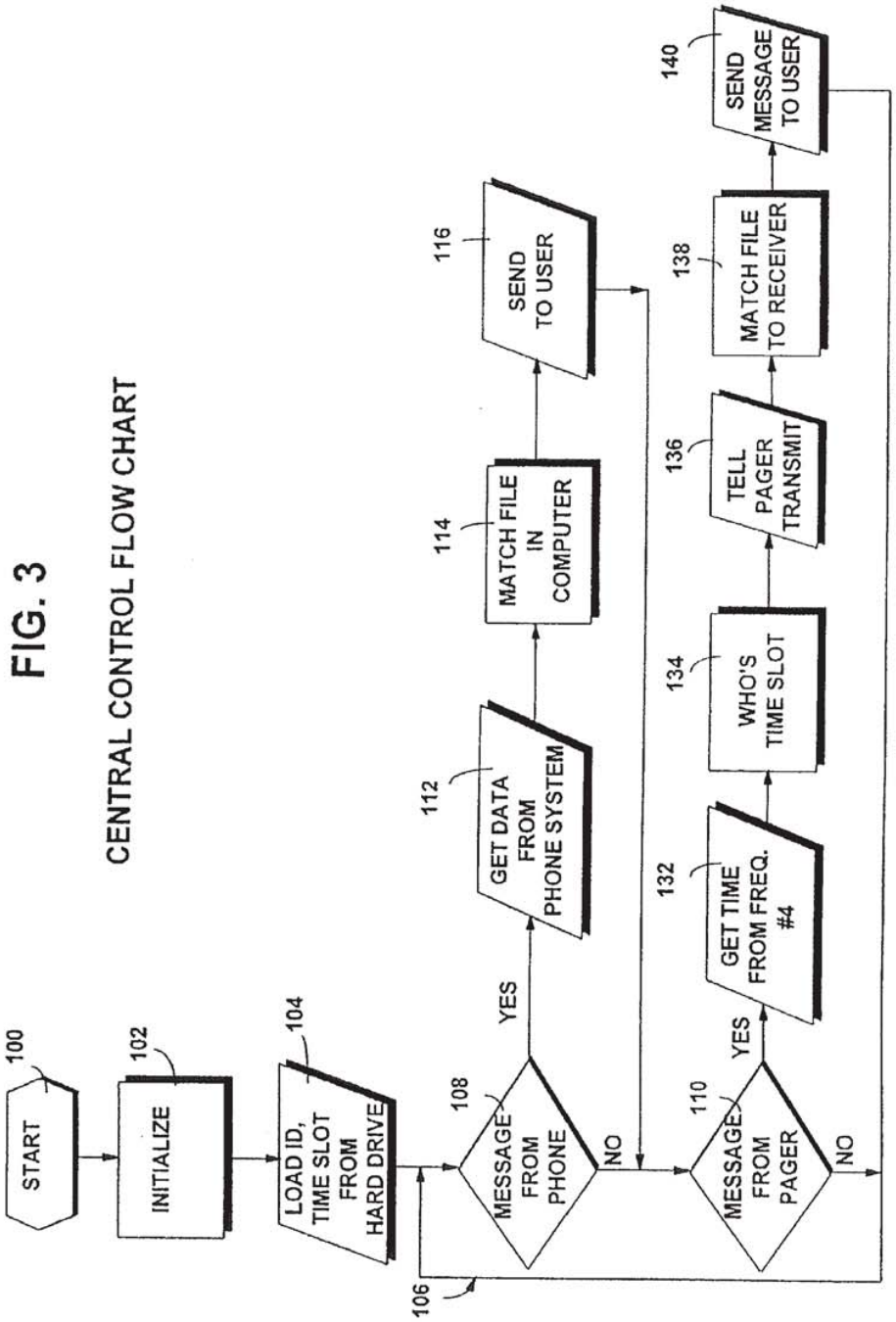

PAGER
22
TRANSMITTER ANT.
76
TRANSMITTER
72
D/S CONVERTER
74
70
ON/OFF
92
BEEPER
94
VIBRATOR
95
8-BIT ENCODER
90
RAM ROM MEMORY
84
LCD DISPLAY
96
I/O INTERFACE
86
MICRO-PROCESSOR
80
KEYBOARD
93
CLOCKUNIT
87
f_1CLK
8-BIT DECODER
88
ARITHMATIC PROCESSOR
82
RECEIVER ANT.
60
RECEIVER
62
S/D CONVERTER
64

FIG. 2

FIG. 3

CENTRAL CONTROL FLOW CHART



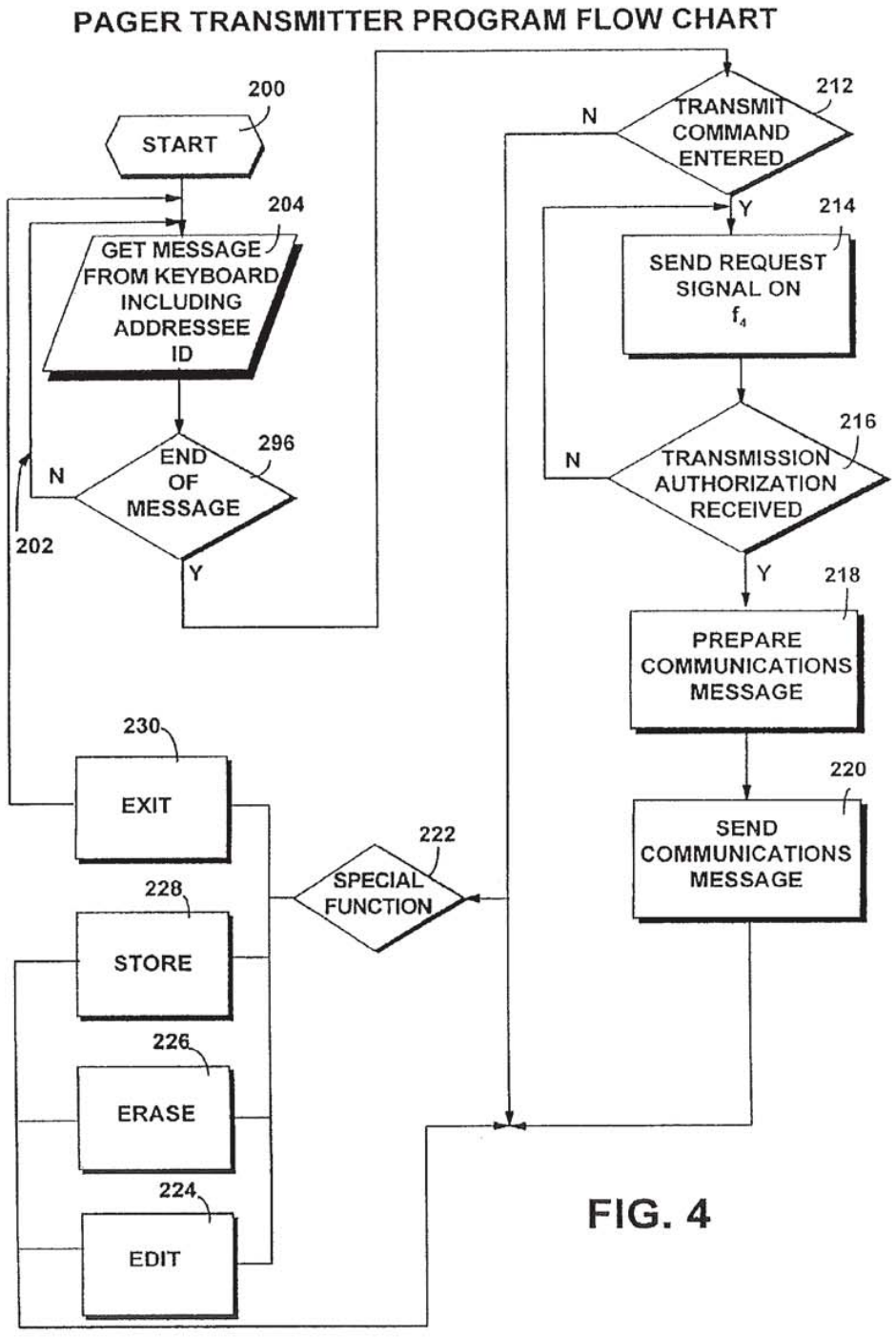

PAGER TRANSMITTER PROGRAM FLOW CHART
200
START
204
GET MESSAGE FROM KEYBOARD INCLUDING ADDRESSEE ID
296
END OF MESSAGE
N
Y
202
212
TRANSMIT COMMAND ENTERED
N
Y
214
SEND REQUEST SIGNAL ON f_4
216
TRANSMISSION AUTHORIZATION RECEIVED
N
Y
218
PREPARE COMMUNICATIONS MESSAGE
220
SEND COMMUNICATIONS MESSAGE
222
SPECIAL FUNCTION
230
EXIT
228
STORE
226
ERASE
224
EDIT

FIG. 4

FIG. 5

PAGER RECEIVER PROGRAM FLOW CHART

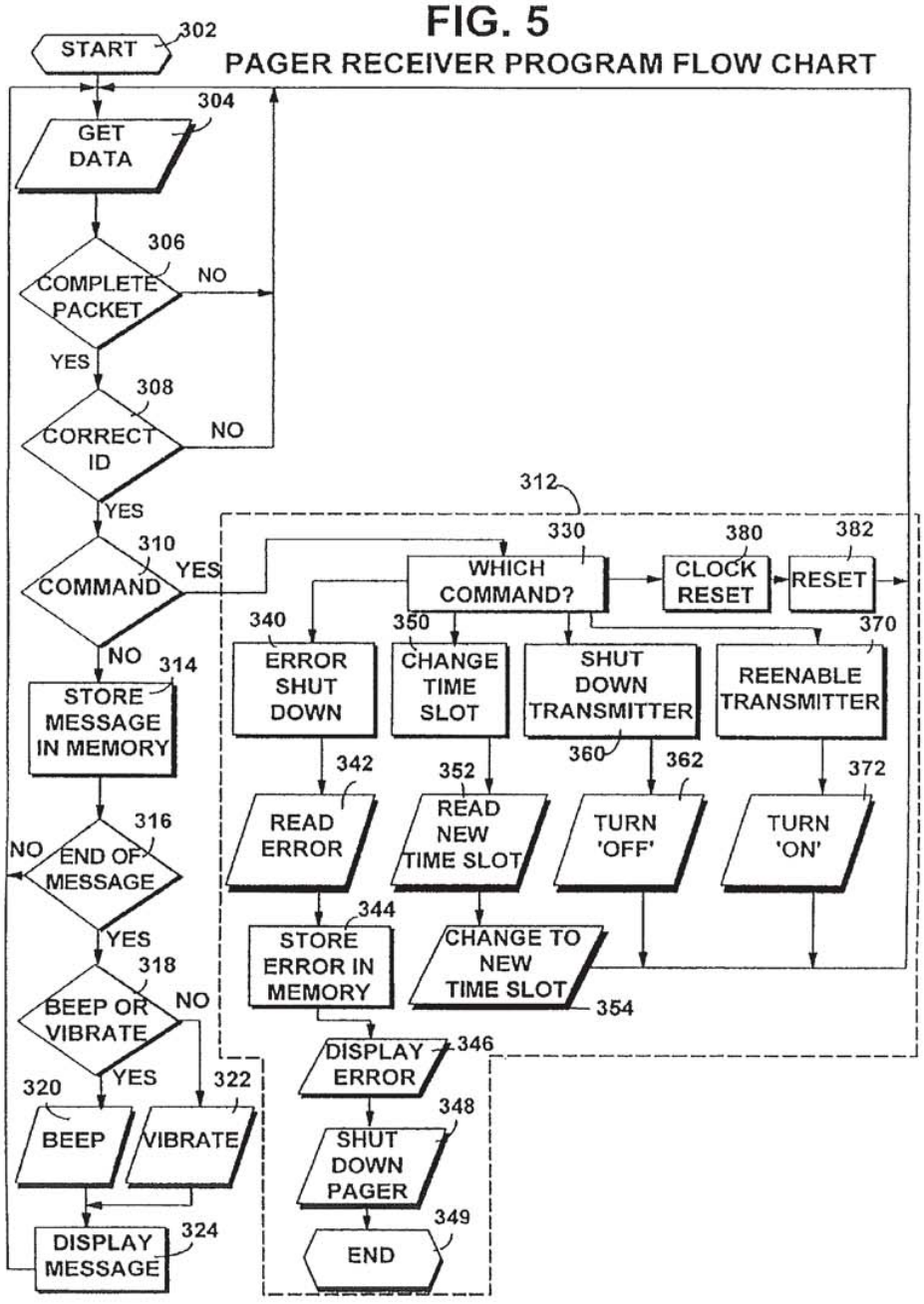


FIG. 6

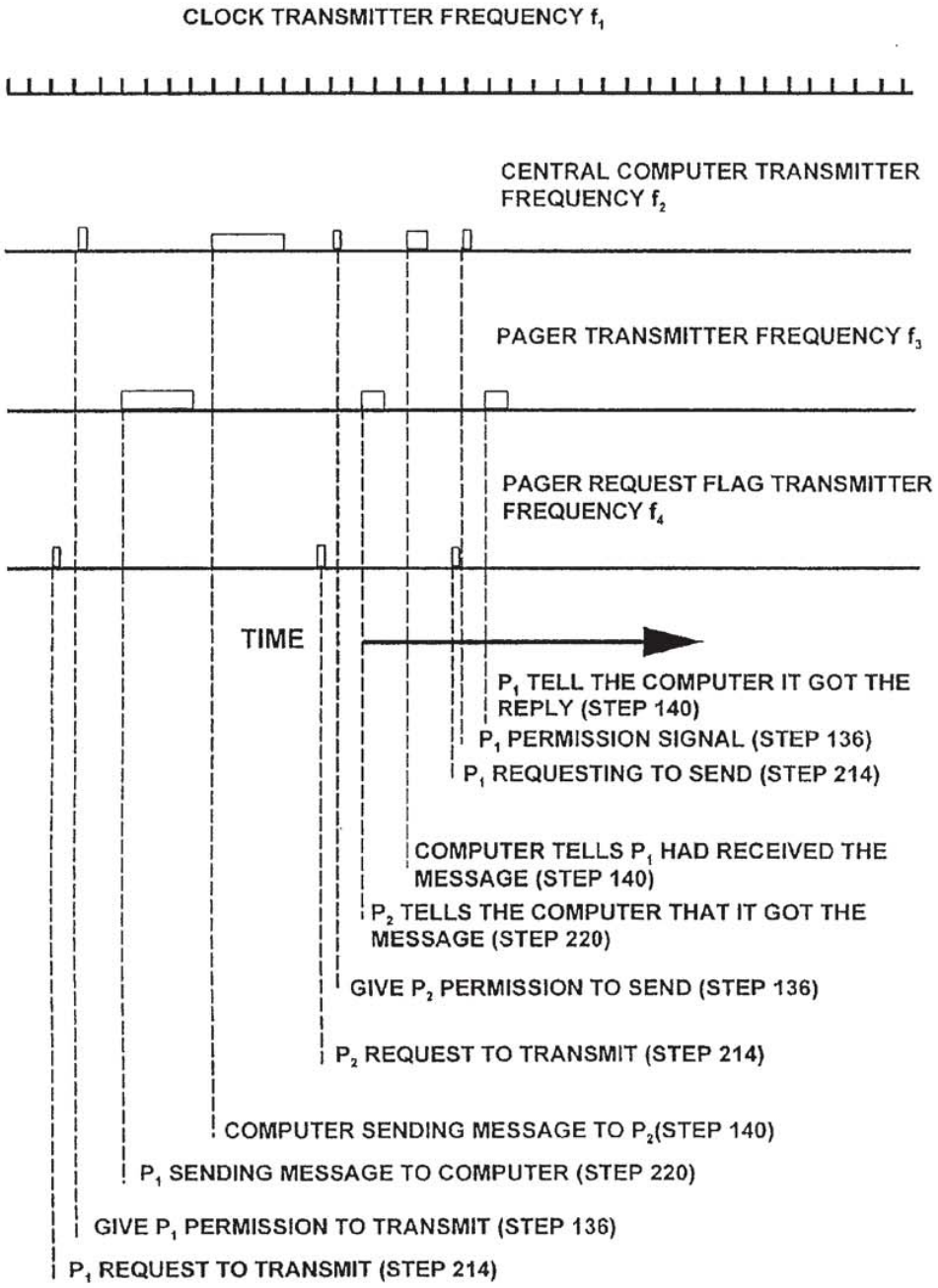

CLOCK TRANSMITTER FREQUENCY f_1
CENTRAL COMPUTER TRANSMITTER FREQUENCY f_2
PAGER TRANSMITTER FREQUENCY f_3
PAGER REQUEST FLAG TRANSMITTER FREQUENCY f_4
TIME
P_1 TELL THE COMPUTER IT GOT THE REPLY (STEP 140)
P_1 PERMISSION SIGNAL (STEP 136)
P_1 REQUESTING TO SEND (STEP 214)
COMPUTER TELLS P_1 HAD RECEIVED THE MESSAGE (STEP 140)
P_2 TELLS THE COMPUTER THAT IT GOT THE MESSAGE (STEP 220)
GIVE P_2 PERMISSION TO SEND (STEP 136)
P_2 REQUEST TO TRANSMIT (STEP 214)
COMPUTER SENDING MESSAGE TO P_2(STEP 140)
P_1 SENDING MESSAGE TO COMPUTER (STEP 220)
GIVE P_1 PERMISSION TO TRANSMIT (STEP 136)
P_1 REQUEST TO TRANSMIT (STEP 214)

FIG. 7

CENTRAL OFFICE LAYOUT

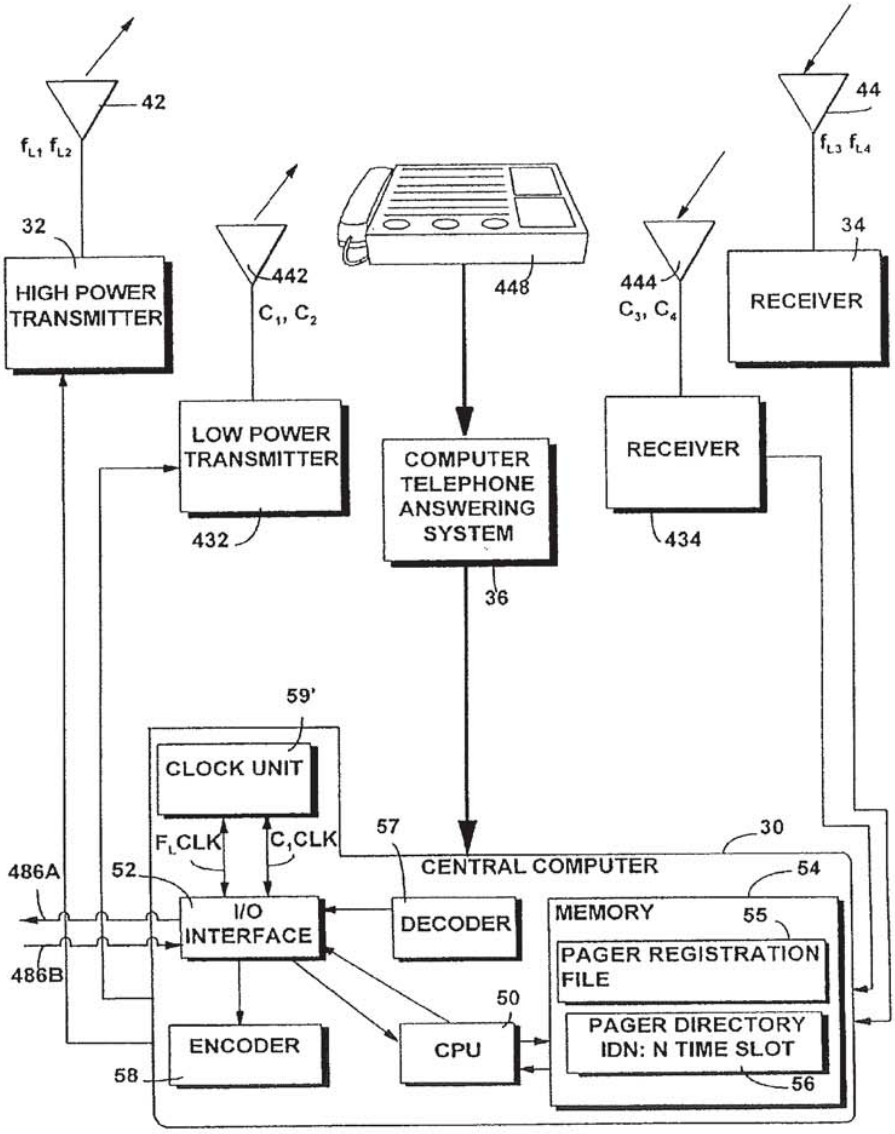


FIG. 8

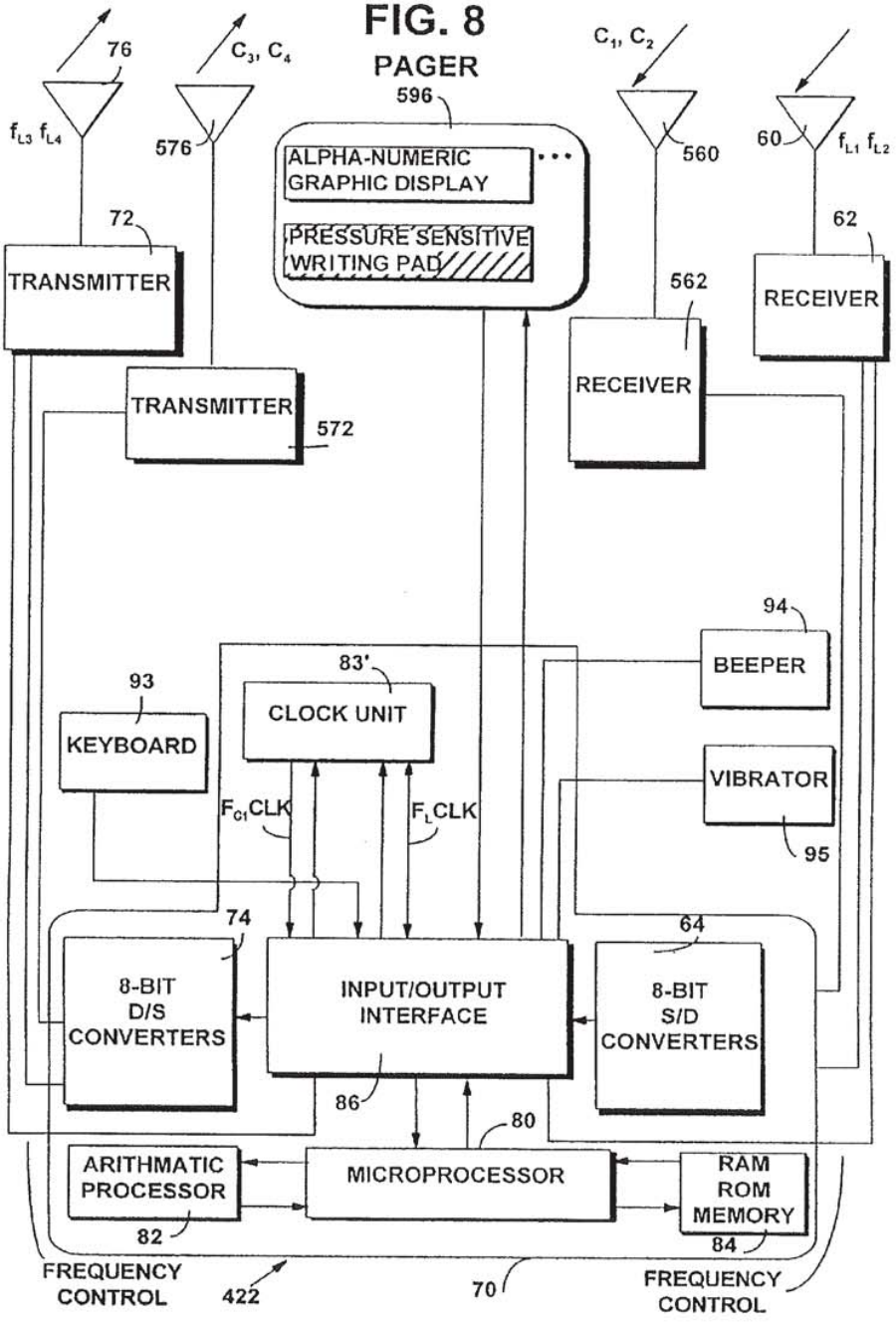
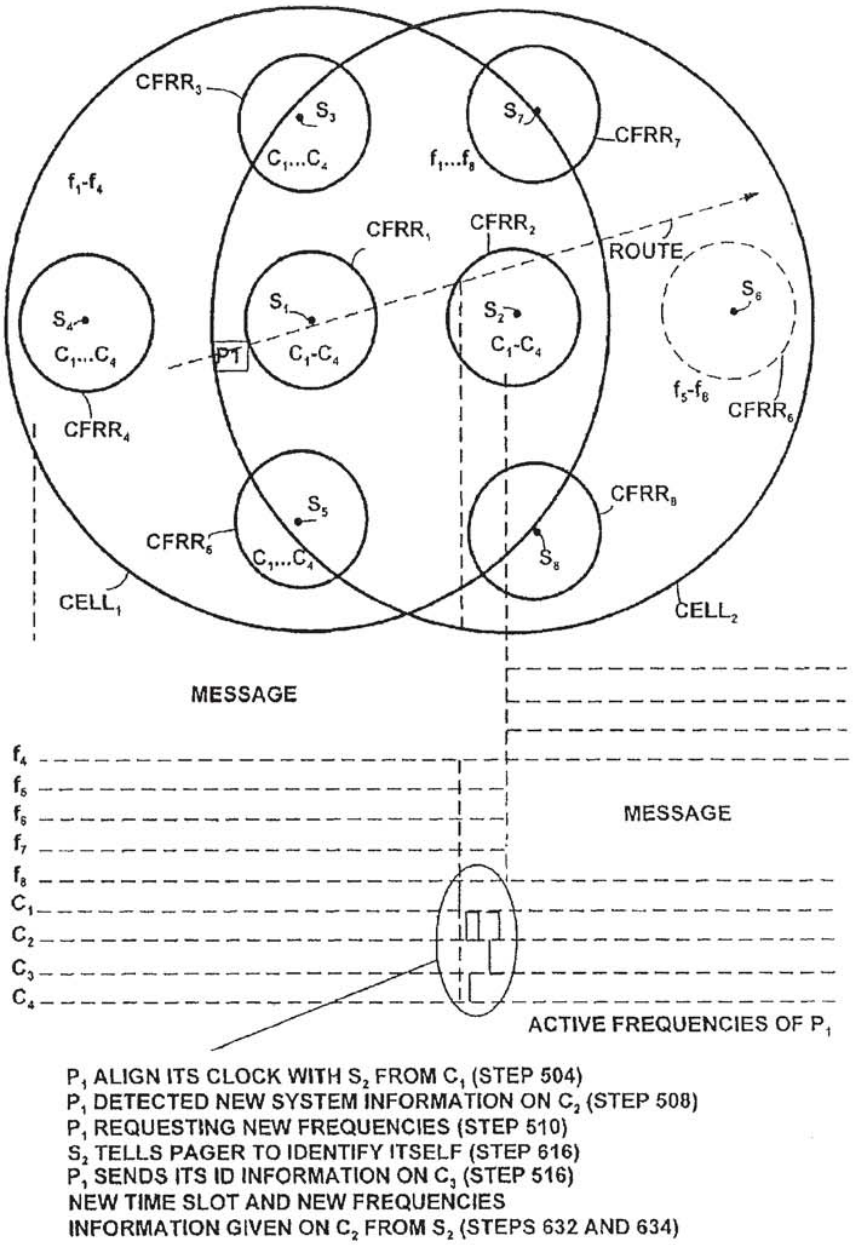

PAGER
596
ALPHA-NUMERIC GRAPHIC DISPLAY
PRESSURE SENSITIVE WRITING PAD
76
f_{L3} f_{L4}
72
TRANSMITTER
C_3, C_4
576
TRANSMITTER
572
C_1, C_2
560
562
RECEIVER
60
f_{L1} f_{L2}
62
RECEIVER
94
BEEPER
83'
CLOCK UNIT
93
KEYBOARD
VIBRATOR
95
F_{C1}CLK
F_LCLK
74
8-BIT D/S CONVERTERS
INPUT/OUTPUT INTERFACE
64
8-BIT S/D CONVERTERS
86
80
ARITHMATIC PROCESSOR
MICROPROCESSOR
RAM ROM MEMORY
82
84
FREQUENCY CONTROL
422
70
FREQUENCY CONTROL

FIG. 9



P1 ALIGN ITS CLOCK WITH S2 FROM C1 (STEP 504)
P1 DETECTED NEW SYSTEM INFORMATION ON C2 (STEP 508)
P1 REQUESTING NEW FREQUENCIES (STEP 510)
S2 TELLS PAGER TO IDENTIFY ITSELF (STEP 616)
P1 SENDS ITS ID INFORMATION ON C3 (STEP 516)
NEW TIME SLOT AND NEW FREQUENCIES
INFORMATION GIVEN ON C2 FROM S2 (STEPS 632 AND 634)

PAGER CHANNEL SWITCHING FLOW CHART

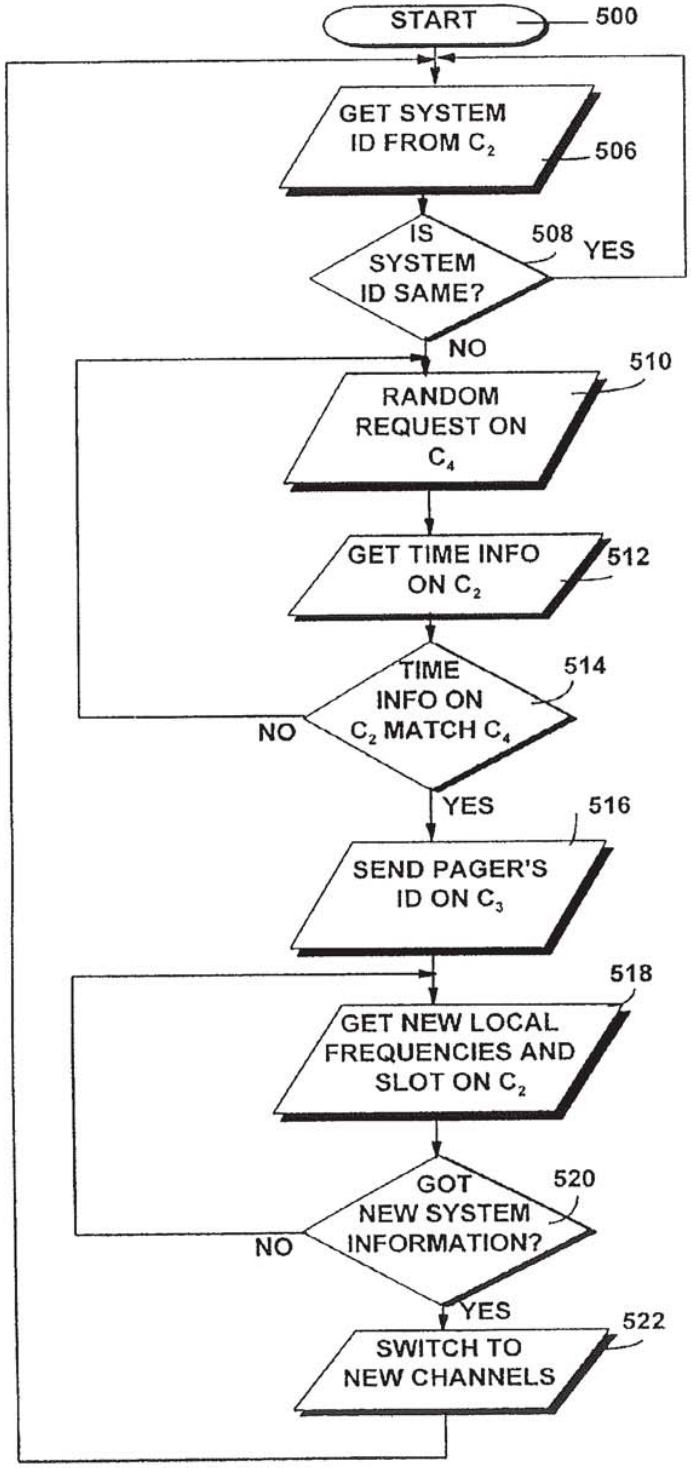
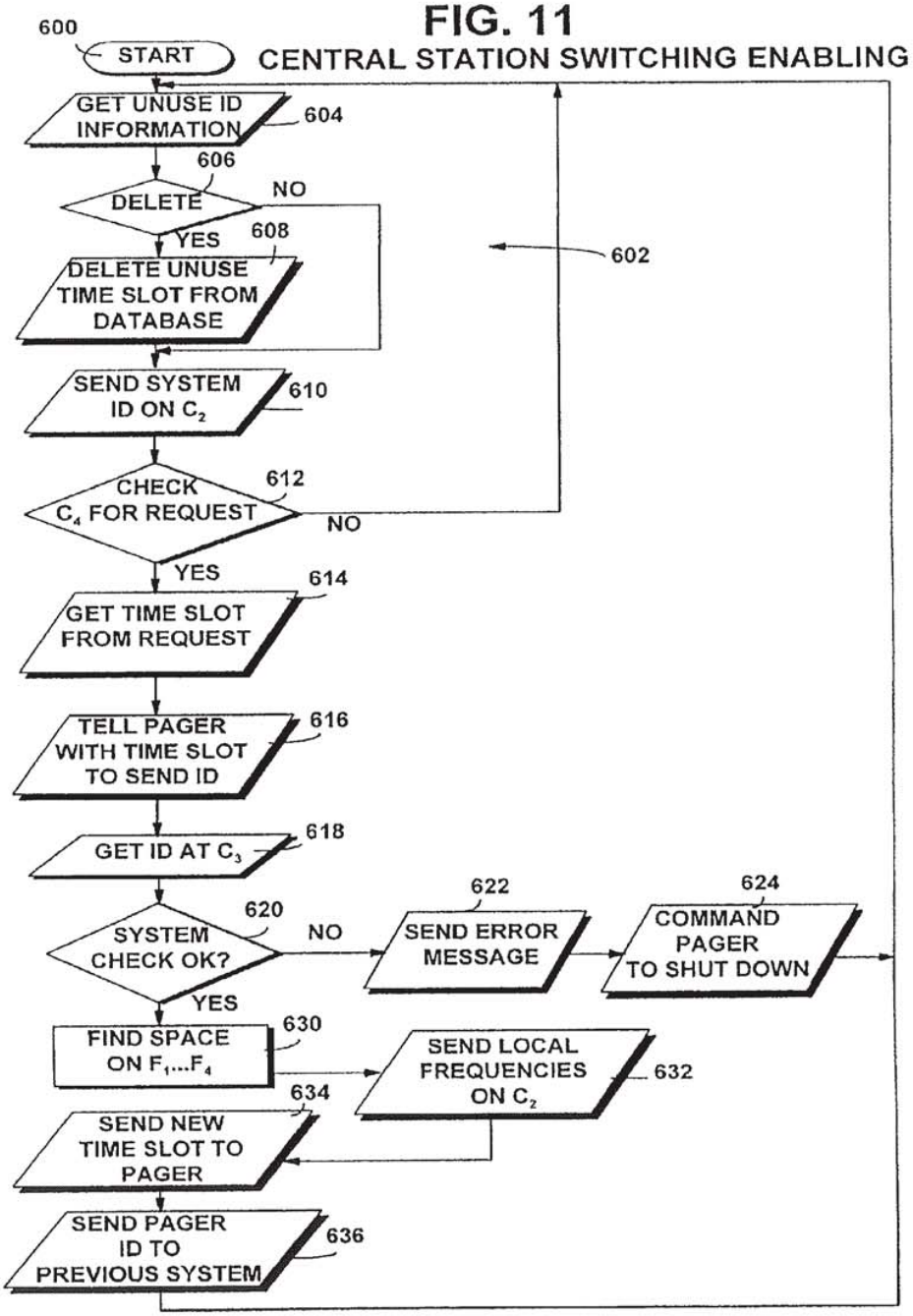


FIG. 10

FIG. 11


600
START
CENTRAL STATION SWITCHING ENABLING
GET UNUSE ID INFORMATION
604
606
DELETE
NO
YES
608
DELETE UNUSE TIME SLOT FROM DATABASE
602
SEND SYSTEM ID ON C_2
610
CHECK C_4 FOR REQUEST
612
NO
YES
614
GET TIME SLOT FROM REQUEST
TELL PAGER WITH TIME SLOT TO SEND ID
616
GET ID AT C_3
618
620
SYSTEM CHECK OK?
NO
622
SEND ERROR MESSAGE
624
COMMAND PAGER TO SHUT DOWN
YES
FIND SPACE ON F_1...F_4
630
SEND LOCAL FREQUENCIES ON C_2
632
634
SEND NEW TIME SLOT TO PAGER
SEND PAGER ID TO PREVIOUS SYSTEM
636

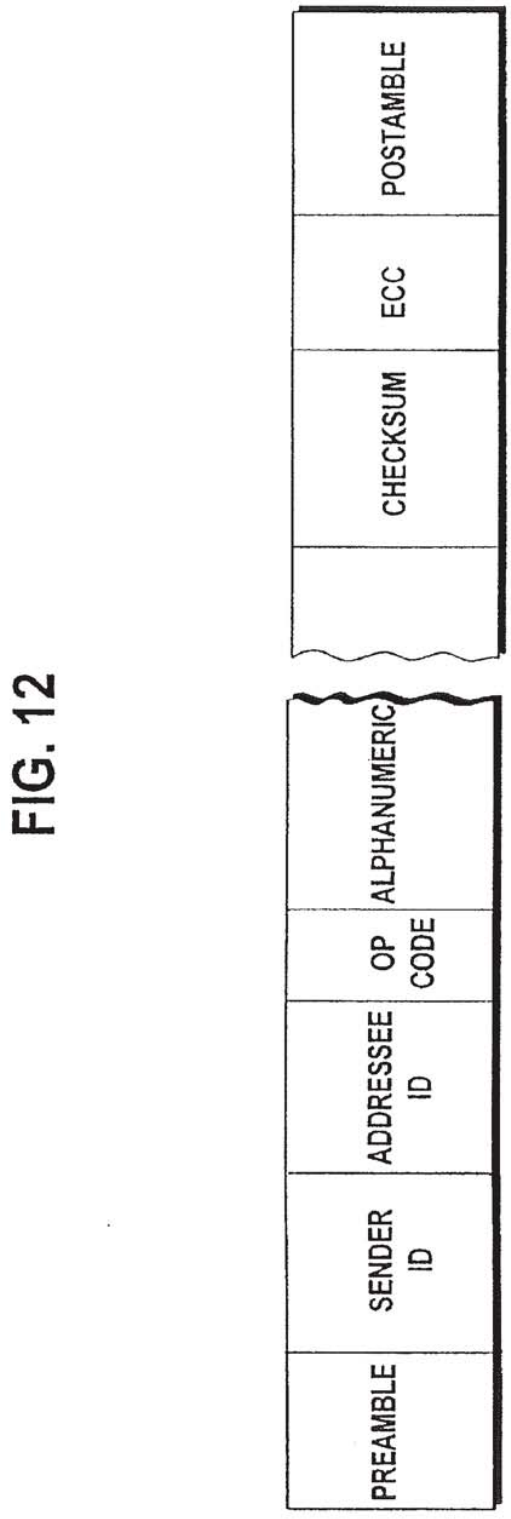
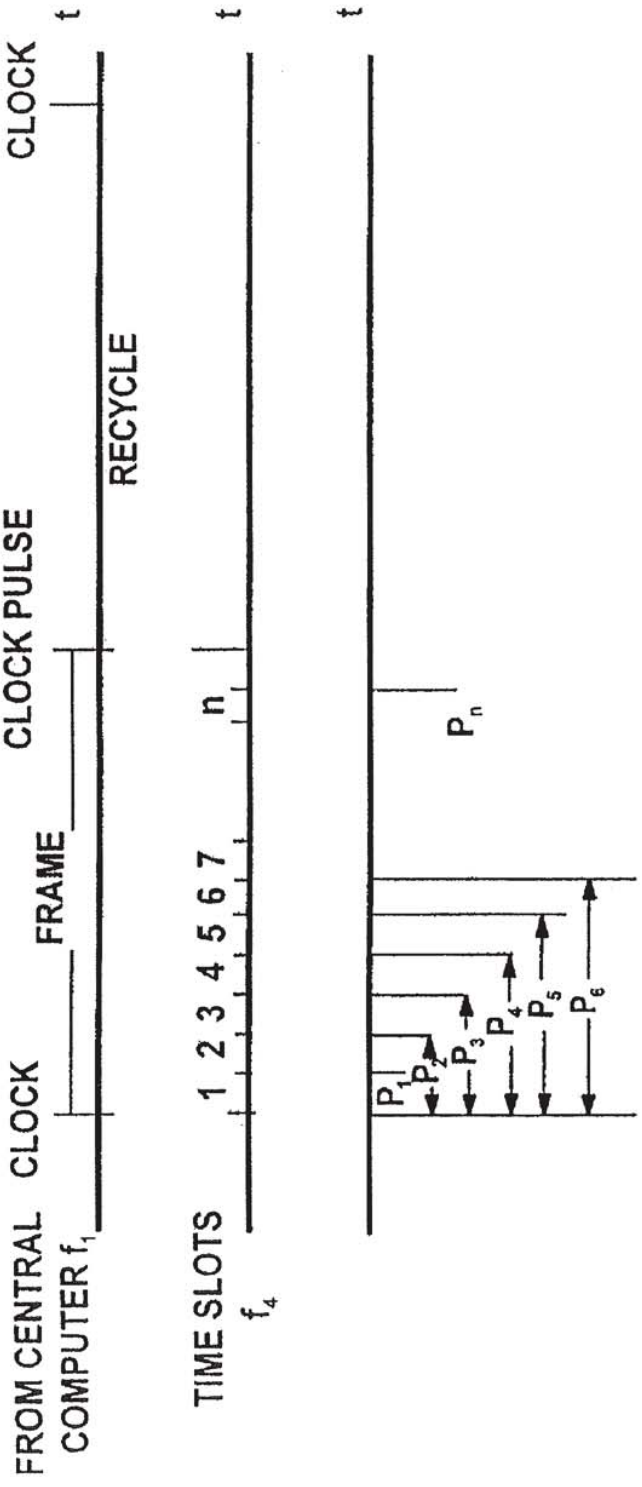

PREAMBLE
SENDER ID
ADDRESSEE ID
OP CODE
ALPHANUMERIC
CHECKSUM
ECC
POSTAMBLE

FIG. 12

FIG. 13


FROM CENTRAL COMPUTER f_1
CLOCK
FRAME
CLOCK PULSE
RECYCLE
CLOCK
t
TIME SLOTS
f_4
1 2 3 4 5 6 7
n
t
P_1
P_2
P_3
P_4
P_5
P_6
P_n
t

COMMUNICATION SYSTEM WHEREIN A CLOCKING SIGNAL FROM A CONTROLLER, A REQUEST FROM A NODE, ACKNOWLEDGEMENT OF THE REQUEST, AND DATA TRANSFERRED FROM THE NODE ARE ALL PROVIDED ON DIFFERENT FREQUENCIES, ENABLING SIMULTANEOUS TRANSMISSION OF THESE SIGNALS

CLAIM OF PRIORITY

This application is a continuation of U.S. patent application Ser. No. 11/668,922 filed on Jan. 30, 2007, which is a continuation of U.S. patent application Ser. No. 11/350,616 filed on Feb. 8, 2006, now U.S. Pat. No. 7,200,406, issued Apr. 3, 2007, which is a continuation of U.S. patent application Ser. No. 09/847,005 filed on May 2, 2001, now U.S. Pat. No. 7,031,716, issued Apr. 18, 2006, which is a continuation of U.S. patent application Ser. No. 09/594,662 filed on Jun. 15, 2000, now U.S. Pat. No. 6,282,406, issued Aug. 28, 2001, which is a continuation of U.S. patent application Ser. No. 09/259,417, filed on Dec. 9, 1997, now U.S. Pat. No. 6,108,520, issued Aug. 22, 2000, which is a continuation of U.S. patent application Ser. No. 08/608,629 filed on Feb. 29, 1996, now U.S. Pat. No. 5,729,827, issued Mar. 17, 1998, which is a divisional of U.S. patent application Ser. No. 08/264,973, filed Jun. 24, 1994, now U.S. Pat. No. 5,542,115, issued Jul. 30, 1996, entitled "PAGING METHOD AND APPARATUS," naming Wong, et al. as inventors, all of these applications being incorporated by reference herein in their entirety.

BACKGROUND

1. Technical Field

This invention pertains to communications paging, and particularly to two-way paging method and apparatus.

2. Related Art

Over the last several decades, pagers have proven to be important communication devices for contacting remotely situated personnel. Whereas primitive pagers provided primarily only a tonal and/or vibratory output, more modern pagers have enhanced output capabilities such as message-bearing alphanumeric displays.

Paging systems have historically been one-way systems. That is, the user receives a paging message from a central terminal but has no way of responding to that message with the pager. Prior art attempts to provide two-way communication capabilities for a pager have included efforts to connect the pager to a telephone (e.g., to a mobile radio telephone). See, for example, U.S. Pat. No. RE 33,417 to Bhagat, et al. (which combines an entire radio pager and radiotelephone linked through an automatic dialer) and U.S. Pat. No. 5,117,449 to Metroka, et. al. (which purports to combine paging and cellular radiotelephone functions in a single unit).

Some pagers have the capability of providing an acknowledgment or response to a paging signal. In some such "ack-back" systems, a user operates a reply input device (e.g., a toggle switch, pushbutton switch, or keyboard) when paged. Typically such ack-back systems involve a complex acknowledgement transmission scheme, involving numerous frequencies or frequency sub-bands. Hand-off of the pager, as the pager travels between differing geographic regions or "cells" served by differing central stations, becomes technically cumbersome when multitudinous frequencies are involved.

SUMMARY

A two-way paging system utilizes four local frequencies for transmissions between pager units and a central control station. A first local frequency carries a local clock; a second local frequency carries communications packets from the central control station to paging units; a third local frequency carries communication packets from the pager units to the central control station; and a fourth local frequency carries a status or request signal from the paging units to the central control station. Transmissions on the fourth local frequency are in accordance with a time divided slot allocation among pager units accessing the central control station.

For a two-way paging system having a plurality of central control stations servicing a corresponding plurality of cells, a total of eight frequencies are utilized within any one cell. Four of the utilized frequencies are the local frequencies (which may differ from cell to cell), and four of the utilized frequencies are lower power common frequencies or switching frequencies which are used to switch or hand-off a pager unit traveling from one cell to another.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. **1** is a schematic view of a central control station included in a paging system of an embodiment of the invention.

FIG. **2** is a schematic view of a pager unit included in a paging system for use with the central control station of FIG. **1**.

FIG. **3** is a flowchart depicting steps executed by the central control station of FIG. **1**.

FIG. **4** is a flowchart depicting steps executed by the pager unit of FIG. **2** when in a transmit mode.

FIG. **5** is a flowchart depicting steps executed by the pager unit of FIG. **2** when in a receive mode.

FIG. **6** is a timing diagram reflecting communications between the central control station of FIG. **1** and the pager unit of FIG. **2**.

FIG. **7** is a schematic view of a central control station included in a paging system of a second embodiment of the invention.

FIG. **8** is a schematic view of a pager unit included in a paging system for use with the central control station of FIG. **7**.

FIG. **9** is a hybrid schematic view and timing diagram for representing switching operations for the paging system of the second embodiment of the invention.

FIG. **10** is a flowchart depicting steps executed by the pager unit of FIG. **8** in connection with a channel switching operation.

FIG. **11** is a flowchart depicting steps executed by the central control station of FIG. **7** in connection with a channel switching operation.

FIG. **12** is a schematic view of a format of a communications packet utilized with embodiments of the invention.

FIG. **13** is a schematic view illustrating a time divided slot allocation technique according to the invention.

DETAILED DESCRIPTION

FIG. **1** shows a central control station **20** according to a first embodiment of the invention; FIG. **2** shows a paging unit **22** suitable for use with central control station **20**.

As shown in FIG. **1**, central control station **20** includes central computer **30**; transmitter **32**; receiver **34**; and computerized telephone answering system **36**. Transmitter **32** transmits, via transmitting antenna **42**, two local frequencies, namely frequency f_1 and frequency f_2. Receiver **34** is connected to receiver antenna **44** for reception of two local frequencies, namely frequency f_3 and frequency f_4. Computerized telephone answering system **36** is connected to a bank of telephones **48**.

Central computer **30** of central control station **20** comprises a conventional computer equipped with typical components including a CPU **50**; I/O interface **52**; and memory **54**. Although shown only generally in FIG. **1**, it should be understood that memory **54** includes a number of unillustrated memory devices, including (for example) a hard disk drive, RAM, and ROM. FIG. **1** shows that memory **54** has stored therein (among other things) a pager registration file **55** and a pager directory file **56**. Pager files **55** and **56** are typically stored on a hard disk drive of central computer **30**, and upon start-up are loadable into a RAM portion of memory **54**.

Central computer **30** of central control station **20** further includes a decoder **57** (connected between receiver **34** and I/O interface **52** for decoding in-coming communications information from one or more pager units **22**), as well as encoder **58** (connected between I/O interface **52** and transmitter **32** for encoding out-going communications information).

Central control station **20** also includes a clock unit **59** which generates a local clock signal $f_1$clk (which, in turn, is used to modulate frequency f_1).

As illustrated further herein, CPU **50** of central control station **20** prepares communications packets for transmission on frequency f_2. As generally illustrated in FIG. **12**, the communications packets are of a predetermined format, having fields for identification of the central control station, for identification of the addressed pager unit(s) **22**, for an operation code, for (optionally) alphanumeric information, and for other conventional packet-type information such as checksum, error correction, and postamble. The preamble and postamble are specially chosen patterns which can be recognized and distinguished from data for the purpose of determining the beginning and ending of a packet. The alphanumeric information can be in a customary binary 8-bit format. The format of FIG. **12** is illustrative only, as such information as the order of the fields can be varied in other embodiments.

Central control station **20** communicates with a plurality of pager units 22_1, 22_2, . . . 22_N. Only one such pager unit, generically referenced as pager unit **22**, is specifically illustrated and described herein, it being understood that the construction and operation of other pager units may be similar to the one illustrated.

As shown in FIG. **2**, pager unit **22** includes a pager receiver antenna **60** which is connected to pager receiver **62**. Pager receiver **62** is, in turn, connected through S/D converter **64** within pager computer **70**. Receiver **62** receives the two local frequencies f_1, and f_2, which frequencies have been modulated to carry in-coming communications information (described in more detail below) to pager computer **70**. On a communications output side, pager computer **70** outputs out-going communications information to pager transmitter **72** via D/S converter **74**. Transmitter **72** broadcasts, on pager antenna **76**, the out-going communications information on the two local frequencies f_3 and f_4.

As also shown in FIG. **2**, pager computer **70** includes pager microprocessor **80** which is connected to each of an arithmetic processor; a memory system **84** (including both ROM and RAM); and I/O interface **86**. I/O interface **86** is connected to a clock unit **87**. I/O interface **86** is also connected to receive in-coming decoded communications information from an 8-bit decoder **88** and to output out-going uncoded communications information to an 8-bit encoder **90**. Decoder **88** is connected to receive in-coming coded communications information from S/D converter **64**; encoder **90** is connected to output out-going coded communications information to D/S converter **74**.

Clock unit **87** is settable by suitable inputs thereto so that clock unit **87** generates a local clock signal $f_1$clk having a frequency corresponding to its input. It should be understood that, in other embodiments, the function of clock unit **87** can be performed at least partially by microprocessor **80** using programmed execution.

I/O interface **86** is also connected to supply an on/off signal on line **92** to pager transmitter **72**, as well as to facilitate input and output with numerous input/output devices. The input/output devices connected to I/O interface **86** include keyboard **93**; beeper **94**; vibrator **95**; and LCD (alphanumeric) display **96**.

Upon manufacture, pager unit **22** is preprogrammed with an identification serial number (e.g., a 7-digit alphanumeric pre-assigned ID number) which is stored in memory **84** (ROM). Pager unit **22** is activated (e.g., at the time of purchase) by inserting a time slot assignment (explained below) both into a predetermined address in memory **84** of pager unit **22** and into pager directory file **56** (stored in memory **54** of central control station **20**).

Operation of First Embodiment

Communication between central control station **20** and pager unit **22** occurs on the four local frequencies, in particular the frequencies f_1, f_2, f_3, and f_4 mentioned above. The first frequency (f_1) carries the local clock-aligning signal from central control station **20** to paging unit **22**. The second frequency (f_2) carries a pager command and alphanumeric data from central control station **20** to paging unit **22**. The third frequency (f_3) carries pager status data and alphanumeric data from paging unit **22** to central control station **20**. The fourth frequency (f_4) carries a pager request signal from paging unit **22** to central control station **20**. In the illustrated embodiment, the frequencies f_1-f_4 are preferably chosen so that $f_1 \neq f_2 \neq f_3 \neq f_4$.

As explained in more detail below and illustrated in FIG. **13**, in normal non-cell-switching operation, the pager request signal on frequency f_4 is transmitted in a predetermined time slot assigned to paging unit **22**. The predetermined time slot on frequency f_4 is related to the clock-aligning signal (carried by frequency f_1) and assigned whereby the fourth frequency is utilizable by a plurality of other paging units. For example, as shown in FIG. **13**, a first time slot on frequency f_4 is assigned to a pager P1; a second time slot is assigned to pager P2, and so on up to time slot n assigned to pager Pn. In the illustrated embodiment, the number of time slots (and accordingly the number of pagers) may be as many as ten thousand or more.

FIG. **3** shows steps executed by CPU **50** of central control station **20** in processing communications to and from one or

more paging units. The steps depicted in FIG. **3** are indicative of instructions stored in a ROM portion of memory **54** of central control station **20**.

When central control station **20** is started up (step **100**), an initialization process (step **102**) is conducted. Included in the initialization process is activation of transmitter **32** (so that transmitter **32** can transmit at the two frequencies f_1 and f_2) and activation of receiver **34** (so that receiver **34** can receive the two frequencies f_3 and f_4). Moreover, frequency f, is modulated to carry the local clock-aligning signal generated by local clock **59**. Then, at step **104**, the pager registration file **55** and the pager directory file **56** are loaded from hard disk into a RAM section of memory **54** (step **104**).

After initialization and loading of the files **55** and **56**, CPU **50** repetitively executes an instruction loop **106**. Loop **106** involves checking to determine (at step **108**) whether a telephone message is being received (via answering system **36** from one of the telephones in bank **48**) and checking to determine (at step **110**) whether a pager message is being received (via transmitter **32** from one of the pager units **22**).

As used herein, a message, whether originated from a telephone or from a pager, may require a plurality of packets for transmission from a central station **20** to a pager **22** or vice versa. In the ensuing discussion, transmission and reception of messages subsumes transmission and reception of one or more packets. In general, the packetization of messages will be invisible to the user, meaning that a user enters a message without regard to the number of packets which might be required to transmit the message. The message typically ends with a user-entered message termination character or message delimiter character. The transmitting device (either central station **20** or pager **22**), allocates the message to one or more packets having a format similar to that of FIG. **12**, with the last packet in the message bearing the message termination character. Alternatively, the packets may be formatted in a manner to indicate the number of consecutively related packets emanating from a transmitter (e.g., there may be a separate packet field indicating the continuation number of related packets).

Central computer **30** can distinguish between receipt of a telephone message (at step **108**) and a pager message (at step **110**) by virtue of the fact that I/O interface **52** generates different types of interrupts to CPU **50** depending on the type of message received. If it is determined at step **108** that a telephone message is being received, steps **112**, **114**, and **116** of FIG. **3** are executed.

In processing a received telephone message, at step **112** central computer **30** extracts out-going communications information from the predeterminately sequenced telephone-entered data. The telephone-entered data, entered via a touch-pad of a calling one of the telephones in bank **48**, includes by convention an identification (e.g., telephone number) of the calling telephone; an identification of the called pager unit (e.g., the 7-digit alphanumeric pre-assigned ID number); and any character data for transmission followed by a termination character. This out-going communications information is received at central computer **30** in standard DTMF format.

At step **114**, using the ID number of the called pager (obtained at step **112**) central computer **30** checks the pager registration file **55** and directory file **56** to determine whether the called pager unit is registered with central control station **20**. Assuming that the called pager is so registered, at step **114** the central computer **30** also obtains from pager directory file **56** the slot assignment for the called pager unit.

At step **116**, central control station **30** transmits communications information to the called pager unit. In this regard, central control station **20** prepares and transmits (on frequency f_2) a communications message which includes, among other things, the ID of the called pager unit and the character data received from the telephone for transmission of the pager unit **22**. After step **116** is executed, processing returns to loop **106**.

If it is determined at step **110** that a pager message is being received, even numbered steps **132-140** of FIG. **3** are executed (prior to returning to loop **106**). As will be seen hereinafter with respect to FIG. **4**, a sending pager unit **22** transmits, in its assigned time slot, a request signal on frequency f_4 when the sending pager unit **22** desires to send a message. As central control station **20** is always monitoring frequency f_4, a request signal carried by frequency f_4 from any pager unit **22** is noted. With reference to the local clock **59**, at step **132** CPU **50** determines in what time slot on frequency f_4 the request signal is detected. Upon detection of the time slot at step **132**, at step **134** CPU **50** consults the pager directory file **56** to determine the identification number of the particular pager unit **22** which originated the request signal.

With the identity of the requesting pager unit **22** now known, at step **136** central control station **20** authorizes the requesting pager unit **22** to transmit its message. In particular, CPU **50** directs preparation of a communications message for transmission on frequency f_2. The particular communications packet prepared at step **136** includes an identification of the requesting pager unit (the addressee of the packet), as well as an operation code ("op" code) which commands/authorizes the requesting pager unit **22** to send its message.

At step **138**, central control station **20** receives a communications message on frequency f_3 sent from the sending (e.g., requesting) pager unit **22**. The communications message prepared and sent by the sending pager unit **22** includes packets of similar format to that shown in FIG. **12**, and includes an identification of a pager to which the message is ultimately addressed as well as its own identification. At step **138**, CPU **50** checks to ensure that the ultimate addressee pager unit is registered in pager files **55** and **56**. At step **140**, CPU **50** makes any necessary reformatting and/or information substitution in the message, and causes the message to be transmitted on frequency f_2. The transmission on frequency f_2 required by step **140** includes the identification of the ultimate addressee (e.g., a pager unit **22**) as well as an operation code indicating that the transmission includes a relayed message from another pager unit.

Steps executed by a pager unit **22** in connection with its transmission mode are depicted in FIG. **4**. Steps executed by a pager unit **22** in connection with its receive mode are depicted in FIG. **5**. The term "mode" as used herein does not connote exclusivity at any particular moment, for it should be remembered that at all times pager unit **22** is receiving transmissions on frequencies f_1 and f_2.

In its transmission mode (see FIG. **4**), after start-up (step **200**) microprocessor **80** of the transmitting pager unit **22** executes a loop **202** wherein user alphanumeric characters (entered via keyboard **93**) are repetitively fetched (at step **204**) until an end of message delimiter is detected (at step **206**). As entered, the characters fetched at step **204** are displayed on LCD display **96**. Entry of the delimiter character at step **206** causes microprocessor **80** to exit loop **202**. By convention, the message must include an addressee ID, which addressee ID is likely the ID of another one of the pager units to which the message entered in step **204** is directed.

After entry of the message awaits entry from keyboard **93** of a transmit command at step **212**. Assuming that the transmit command is entered at step **212**, microprocessor **80** prepares and sends a request signal on frequency f_4. As indicated before, the request signal is transmitted on frequency f_4 in a

time slot assigned to the requesting pager unit **22**. It should be kept in mind that pager unit **22** is all the while receiving the local clock-aligning signal on frequency f_1, which enables microprocessor **80** to cause transmission of the request signal on frequency f_4 at a time corresponding to the specific time slot allotted to the particular sending pager unit **22**.

In the above regard, in accordance with time division techniques, each pager unit 22_1-22_N (e.g., pagers P_1-P_N in FIG. **13**) is assigned a selected one of N number of time slots on frequency f_4.

After transmission of the request signal at step **214**, pager unit **22** awaits receipt of a transmit command from central control station **20**. Preparation and transmission of the transmit command/authorization from central control station **20** is described with reference to FIG. **3**. Upon receipt of the transmit command/authorization from central control station **20** (step **216**), microprocessor **80** prepares (at step **218**) a communications message with one or more packets having a format much like that of FIG. **12**. The addressee ID and alphanumeric field of packets of the communications message is filled with the message entered in loop **202**. At step **220**, the sending pager unit **22** broadcasts the communications packet on frequency f_3.

If a transmit command is not entered at step **212**, or after transmission of the message at step **220**, microprocessor **80** awaits entry of at least one of several possible special function keys at step **222**. For example, the user may press a function key which requires storage of the message (whether yet transmitted or not) [see step **228**]. Alternatively, the user may press function keys which facilitate editing or erasure of the message (see steps **224** and **226**, respectively). To complete the message and begin work on another message, a special function key for an exit operation (step **230**) must be pressed.

FIG. **5** depicts steps executed by microprocessor **80** of pager unit **22** when in a receive mode. After start-up (step **302**), and as indicated by step **304**, pager unit **22** receives transmissions from central control station **20** on frequency f_2. Once a complete packet is received (determined at step **306**), a check is made (at step **308**) whether the addressee ID in the communications packet (see packet format of FIG. **12**) is the ID of the receiving pager unit **22**. If the determinations of either step **306** or **308** are negative, pager unit **22** awaits either completion of the communications packet (in the case of step **306**) or receipt of another communications packet (in the case of step **308**) by looping back to step **304**.

Assuming that the received communications packet is designated for this particular receiving pager unit **22**, at step **310** microprocessor **80** consults the operation code field of the communications packet (see FIG. **12**) to determine if the operation code indicates that the message includes a command. If the operation code indicates a command, a command processing routine (framed by broken lines **312** in FIG. **5**) is executed.

Assuming for the moment that the operation code does not indicate a command, at step **314** microprocessor **80** of pager unit **22** stores the alphanumeric field portion of the communications packet (which at least partially forms the message) in a RAM portion of memory **84**. Since a message communicated from central processing station **20** may require several communications packets for completion of the message (with subsequent communication packets providing continuations of the message content), microprocessor **80** checks at step **316** to ensure that the entire message has been received. If not, processing continues back at step **304** for reception of a further communications packet.

Upon reception of an entire communications message, at step **318** microprocessor **80** determines whether pager unit **22** is in a beep mode or a vibrate mode. In this regard, there are numerous ways of setting paging unit **22** to the desired mode, either by a specially dedicated switch on paging unit **22** or by data entry using keyboard **93**. If pager unit **22** is in a beep mode, microprocessor **80** outputs a signal which causes I/O interface **86** to issue a further signal to activate beeper **94** (step **320**). Alternatively, if pager unit **22** is in a vibrate mode, microprocessor **80** outputs a signal which causes I/O interface **86** to issue a further signal to activate vibrator **95** (step **322**).

At step **324**, microprocessor **80** directs I/O interface **86** to send the alphanumeric message data to LCD display **96**, so that the received message can be viewed by the user.

After notification to the user (either via beeper **94** and/or vibrator **95**), and display (on LCD **96**) of the received alphanumeric data, microprocessor **80** returns to step **304** to check whether further communications packets are being received.

The command processing routine (framed by broken lines **312** in FIG. **5**) first determines (step **330**) which particular operation is being commanded. This determination is based on the content of the operation code, which is different for different command types. If the operation code indicates an error shut-down, execution jumps to an error shut-down sub-routine which begins at step **340**. If the operation code indicates a time slot change, execution jumps to a change time slot sub-routine which begins at step **350**. If the operation code requires transmitter shut-down, execution jumps to a transmitter shut-down sub-routine which begins at step **360**. If the operation code requires transmitter re-enablement, execution jumps to a transmitter reenable sub-routine which begins at step **370**. If the operation code requires clock re-set, execution jumps to a clock re-set sub routine which begins at step **380**.

In connection with the error shut down sub-routine, at step **342** microprocessor **80** obtains an indication of error type from the communications packet. The error type is stored in memory **84** (step **344**) and then displayed on LCD display **96** (step **346**). Then microprocessor **80** issues a command (at step **348**) to shut down pager unit **22**, which shut-down occurs at step **349**.

In connection with the time slot changing sub-routine, at step **352** microprocessor **80** extracts, from the received communications packet, information indicative of the new time slot assigned to the receiving pager unit **22**. The new time slot is entered (at step **354**) into memory **84** and thereafter utilized (until further change) in connection with transmission of request signals on frequency f_4 (see, for example, step **214** of FIG. **4**).

The time slot changing sub-routine may also include other operations, if desired, including (for example) eliminating unused time slots (thereby increasing scanning rate); diagnosing and trouble shooting; and avoiding interruption of service from malfunctioning or ill-functioning equipment.

In connection with the transmitter shut down sub-routine, at step **362** microprocessor **80** directs I/O interface **86** to issue an OFF command to transmitter **72**. In connection with the transmitter re-enable sub-routine, at step **372** microprocessor **80** directs I/O interface **86** to issue an ON command to transmitter **72**.

In connection with the clock re-set sub-routine, at step **382** microprocessor **80** directs that clock **59** of pager unit **22** be set.

After execution of steps **354**, **362**, **372**, or **382**, execution continues back to step **304** for processing of potential further communications packets. Thus, unless an error shut-down is noted, each entry of the command processing routine (framed by broken lines **312** in FIG. **5**) is followed by a loop back to step **304**.

FIG. **6** is a timing diagram showing the frequencies f_1-f_4 and integration of the steps depicted in FIGS. **3-5**, particularly in the context of a request by a sending pager unit **P1** for sending a message to a sendee pager unit **P2**. As employed in FIG. **6**, "computer" refers to central control station **20**. It should be understood that the sending pager unit **P1** and the sendee pager unit **P2** operate in both the transmission mode as depicted in FIG. **4** and in the receiver mode as depicted in FIG. **5**. In general, FIG. **6** shows transmission of a message from pager unit **P1** (via central control station **20**) to pager unit **P2**; transmission of a confirmation message from pager unit **P2** (via central control station **20**) to pager unit **P1**; and transmission of a message from pager unit **P1** to central control station **20** indicating that pager unit **P1** received the confirmation message from pager unit **P2**.

Structure of Second Embodiment

FIG. **7** shows a central control station **420** according to a second embodiment of the invention; FIG. **8** shows a paging unit **422** suitable for use with central control station **420**.

FIG. **9** shows a wide area paging system including a plurality of central control stations **S1-S8** (each identical to central control station **420**), each preferably geographically centered within a respective cell. Each central control station **S1-S8** broadcasts its own local frequencies, as well as a set of common or switching frequencies C_1-C_4. The common frequencies C_1-C_4 are broadcast at a lower power, so that reception thereof occurs only in a relatively small neighborhood or common frequency reception region (CFRR) [also referred to as a "switching region"] about the central control station. The local frequencies are broadcast at a significantly greater power for reception substantially throughout the cell. For example, in FIG. **9**, central control station **S1** broadcasts its lower power common frequencies C_1-C_4 to $CFRR_1$ and its higher power local frequencies f_1-f_4 to CELL; central control station **S2** broadcasts its lower power common frequencies C_1-C_4 to $CFRR_2$ and its higher power local frequencies f_5-f_8 to $CELL_2$.

As also shown in FIG. **9**, $CELL_1$ and $CELL_2$ overlap in an overlap region shown in FIG. **9**. Station **S1** utilizes a set of local frequencies f_1-f_4; station **S2** utilizes a different set of local frequencies f_5-f_8. Both stations **S1** and **S2** utilize the same set of common or switching frequencies C_1-C_4. Thus, each central control station utilizes two sets of frequencies, there being four frequencies in each set, resulting in a total of eight frequencies handled per station.

Thus, the second embodiment of the invention is suitable for a system having a plurality of central control stations $\mathbf{420}_x$ where x=1, 2, . . . M. Each central control station $\mathbf{420}_x$ transmits and receives a set of local frequencies f_{L1}, f_{L2}, f_{L3}, f_{L4} in an associated geographical area or cell, as well as the set of common or switch frequencies C_1, C_2, C_3, C_4. While the values of the local frequencies f_{L1}, f_{L2}, f_{L3}, f_{L4}, vary from cell to cell (e.g., differ for differing central control stations $\mathbf{420}_x$), the values of the common or switch frequencies C_1, C_2, C_3, C_4 are uniform through the system (e.g., for all central control stations $\mathbf{420}_x$).

Although not shown in FIG. **9**, it should be understood that the pattern of central control stations repeats in like manner in all compass directions in accordance with the prescribed geographical boundaries of the paging system. Moreover, although not specifically illustrated in FIG. **9**, it should also be understood that each central control station **420** has an associated CFRR.

The common or switching frequencies C_1-C_4 have an analogous function to the corresponding local frequencies f_1-f_4, respectively. In this regard, frequency C_1 carries a clock frequency transmitted by central control station(s), although the clock rate on common frequency C_1 preferably varies among central control stations. Frequency C_2 is used to transmit information from central control station(s) to pager unit(s); frequency C_3 is used to transmit information from a pager unit to a central control station; frequency C_4 is used by pager units to issue a request signal. Frequency C_2 carries packets having a format similar to that of FIG. **12**. In analogous manner to frequency f_2, the packets carried by frequency C_2 may have command codes. Among the C_2 command codes are a SYSTEM COMMAND CODE; a LOCAL FREQUENCY DOWNLOAD COMMAND CODE; a SLOT RECOGNITION COMMAND CODE; and a SLOT ASSIGNMENT COMMAND CODE.

As shown in FIG. **7**, central control station **420** resembles central control station **20** of the embodiment of FIG. **1** (similar components being assigned the same reference numerals for simplicity). However, central control station **420** is augmented by inclusion of a further transmitter, known as common frequency transmitter **432**, together with its common frequency transmission antenna **442**, for transmitting the common frequencies C_1 and C_2. In contrast to the high power transmitter **32**, transmitter **432** is a low power transmitter. Further, central control station **420** is augmented by inclusion of a further receiver, known as the common frequency receiver **434**, together with its common frequency receiver antenna **444**, for reception of the common frequencies C_3 and C_4.

Central control station **420** of FIG. **7** includes a clock unit **59'** which generates two clocking signals—a first or local clocking signal $f_L$clk and a second or common clocking signal C_1clk. The local clocking signal $f_L$clk is used to modulate frequency f_1; the common clocking signal is used to modulate the common frequency C_1.

The central computers **30** of the central control stations $\mathbf{420}_x$ are serially connected to one another by an output line **486A** and an input line **486B**. In particular, although not expressly shown as such in FIG. **7**, computer **30** of FIG. **7** (like that of FIG. **1**) includes an I/O interface to which the serial lines **486A** and **486B** are connected. Serial lines **486A** and **486B** are used, for example, to update contents of the pager registration file **55** and the pager directory file **56**.

As shown in FIG. **8**, pager unit **422** resembles pager unit **22** of the embodiment of FIG. **2** (similar components again being assigned the same reference numerals for simplicity). However, pager unit **422** (in like manner as central control station **420**) is augmented by inclusion of a further transmitter, known as common frequency transmitter **572**, together with its common frequency transmission antenna **576**, for transmitting the common frequencies C_3 and C_4. Further, central control station **420** is augmented by inclusion of a further receiver, known as the common frequency receiver **434**, together with its common frequency receiver antenna **444**, for reception of the common frequencies C_1 and C_2.

The operational frequencies of transmitter **72** and receiver **62** are changeable in accordance with values transmitted on "frequency control" lines from computer **70**. In particular, the frequency control lines are connected to I/O interface **86** in computer **70**. As described in more detail below, when a pager unit **422** migrates into a new CFRR, signals are applied on the frequency control lines in order to switch pager unit **422** from the local frequencies of an old cell to the local frequencies of a new cell associated with the new CFRR into which pager unit **422** migrates.

Pager **422** includes a clock unit **83'** which is capable of separately generating local clocking signals $f_L$clk and the

common clocking signals f_{c1}clk for use by microprocessor **80**. These clocking signals are initiated and their frequencies set by appropriate respective inputs to clock unit **83'**.

FIG. **8** also shows that pager unit **422** has data I/O unit **596** which includes both an alphanumeric graphic display and a pressure sensitive writing pad. The alphanumeric graphic display is a dot matrix device which can display characters and graphics. The writing pad has a 16x48 dot area.

Operation of Second Embodiment

As shown in FIG. **9**, a pager unit P1 is assumed to have been operating in $CELL_1$ and to have previously received the common frequencies C_1-C_4 and local frequencies f_1-f_2 from station S1. Now pager unit P1 travels on a route indicated by broken arrow-headed line ROUTE. In traveling along the ROUTE, pager unit P1 continues to operate on local frequencies f_1-f_2, even as it travels through the cellular overlap region. However, when pager unit P1 enters a new common frequency reception region (i.e., $CFRR_2$), a switching or hand-off operation occurs. In the switching operation, as explained in more detail below, pager unit P1 obtains common frequencies C_1-C_4 from central control station S2 and, as a result, can switch from the local frequencies f_1-f_4 of $CELL_1$ to the local frequencies f_5-f_8 of $CELL_2$. In order to effect the switching or hand-off operation, pager unit P1 executes a channel switching routine; the central control station S2 executes a switching enabling routine.

In connection with the channel switching routine and the switching enabling routine, when pager unit P1 moves into $CFRR_2$, pager unit P1 will receive the clocking signal on frequency C1 from station S2. At such point, pager unit P1 will automatically align its clock unit with the clocking signal from station S2.

Referring now to the channel switching routine executed by pager P1 subsequent to start-up (step **500**), at step **506** pager unit P1 obtains information characterizing the system centered about station S2. Such characterizing information is referred to as system identification or system ID information.

At step **508**, microprocessor **80** of pager unit P1 checks to determine if there is any new system ID information acquired on frequency C_2. That is, microprocessor **80** checks to determine if system ID information is received on frequency C_2 (which can occur only in a CFRR) and, if so, compares the system ID information to the immediately previously-stored system ID information. If the previous and most recently-acquired system IDs are the same, pager unit P1 realizes that it is still in the jurisdiction of the same station (e.g., station S1). If not, pager unit P1 realizes that it has now wandered into a CFRR of a new station (e.g., station S2) and, at step **510**, initiates a request on frequency C_4 for communication with the central control station (e.g., station S2) for $CELL_2$.

In the above regard, since pager unit P1 has not yet been assigned a time slot for $CELL_2$, the request on frequency C_4 is randomly made. However, pager unit P1 keeps track of the time slot in which it makes its request to the new central control station (e.g., station S2).

Thereafter, pager unit P1 continues to monitor (step **512**) communications packets from station S2 on frequency C_2, waiting for station S2 to issue a message which references the time slot at which pager unit P1 made its request of step **510**. In particular, pager unit P1 awaits a message from station S2 on frequency C_2 that includes both a SLOT RECOGNITION COMMAND CODE and information stored in the same time slot which pager unit P1 randomly generated. Since the message including the SLOT RECOGNITION COMMAND CODE includes station S2 as the sender and mirrors the slot randomly generated by pager unit P1, pager unit P1 recognizes the message as being addressed to pager unit P1 and considers issuance of such a message by station S2 (see step **612** of FIG. **11**) to constitute authority for pager unit P1 to communicate further with station S2. In this regard, at step **514** microprocessor **80** of pager unit P1 determines if there is a match between the time slot of a received message and the time slot at which the random request was made at step **510**.

Assuming a match is eventually found at step **514**, at step **516** pager unit P1 sends a communications packet on frequency C_3 to station S2, with the communications packet including the identification or ID of pager unit P1. Using pager registration file **55**, station S2 verifies that the ID of pager unit P1 is a valid ID, and thereafter sends (on frequency C_2) to pager unit P1 a message with the command code LOCAL FREQUENCY DOWNLOAD, which message informs pager unit P1 of the values of the local frequencies handled by station S2 (e.g., frequencies f_5-f_8). Thereafter, as also reflected by step **518**, station S2 sends (on frequency C_2) to pager unit P1 a message with the command code SLOT ASSIGNMENT COMMAND CODE, which message informs pager unit P1 of its slot assignment on frequency f_8. Microprocessor **80** then changes its slot allocation by steps which are similar to those discussed with the afore-mentioned change time slot routine (see steps **350**, **352**, and **354** of FIG. **5**). Step **518** of FIG. **10** reflects reception of the local frequency values and reception of the slot assignment.

After acquisition of all local frequencies and the slot assignment is completed (step **520**), microprocessor **80** implements (at step **522**) a switch to the new local frequencies (e.g., frequencies f_5-f_8). In this regard, microprocessor **80** instructs I/O interface **86** to change transmitter **72** from frequencies f_3, f_4 to frequencies f_7, f_8; and to change receiver **62** from frequencies f_1, f_2 to frequencies f_5, f_6. I/O interface **86** accomplishes the frequency changes by applying appropriate values on the frequency control lines connecting the I/O interface to transmitter **72** and receiver **62**, respectively.

After the switch to new local frequencies at step **522**, microprocessor **80** loops back to step **506**, ultimately to determine when any further switching may be required.

Steps involved in the switching enabling routine executed by a central control station (e.g., station S2) are depicted in FIG. **11**. After start-up (step **600**), CPU **50** executes a loop **602** which enables CPU **50** to clean up its pager directory file **56** and to check if any new pager units have wandered into the cell which it administers.

In particular, at step **604** CPU determines whether its central control station (e.g., S2) has been advised by any other central control station (e.g., S3) that a pager unit, formerly under the control of its central control station (e.g., S2), has come under the control of the other central control station (e.g, S3). Such advisement occurs on the serial links connecting the central control stations 420_x, and particularly input serial link **486**B. If such advisement occurs, the ID for the wandered-away pager is deleted from the pager directory file **56** for station S2 (as reflected by steps **606** and **608**).

At step **610**, CPU **50** causes messages with a SYSTEM COMMAND CODE to be transmitted on frequency C_2. As indicated before, messages transmitted on frequency C_2 include a packet(s) having a format such as that shown in FIG. **12**. The message with the SYSTEM COMMAND CODE particularly includes the central station ID number in its alphanumeric data field.

At step **612**, central control station **420** checks to determine if a request signal has been transmitted by any pager unit **422** on frequency C_4 (as occurred, for example, in context of the discussion of FIG. **10**, particularly step **510**). Such a request

signal would likely be issued from a pager unit **422** which has just wandered into the CFRR controlled by the central control station (e.g., into $CFRR_2$ controlled by station S2). If no such request signal is detected, loop **602** is again repeated.

In the event that a request signal is detected at step **612**, central control station **420** notes specifically the time slot on frequency C_4 at which the request occurred (step **614**). At this point, such time slot is the only way central control station **420** can identify the in-wandering pager unit **422**. Central control station **420** desires for the in-wandering pager unit **422** to transmit its identification (ID), but cannot specifically address the in-wandering pager other than with reference to the detected time slot. Accordingly, at step **616**, central control station **420** prepares and transmits a message on frequency C_2 which has a SLOT RECOGNITION COMMAND CODE. The message including the SLOT RECOGNITION COMMAND CODE includes station S2 as the sender and mirrors the slot randomly generated by pager unit P1 (e.g, the time slot at which the in-wandering pager unit **422** issued its request). This transmission on frequency C_2 constitutes authority for pager unit P1 to transmit its identification.

Step **618** denotes acquisition by central control station **420** of the identification (ID) of the in-wandering pager unit **422**. At step **620**, central control station **420** checks its pager registration file **55** to determine if the pager ID is a valid ID. If not, an error message is generated and transmitted (at step **622**), followed by a command for pager unit P1 to shut down (see step **624**).

Assuming that the identification of pager unit **422** was validated at step **620**, CPU **50** checks (at step **630**) its pager directory file **56** to locate an available time slot for the in-wandering pager unit **422**, and then associates the available time slot with the ID of the in-wandering pager unit **422**. Then, at step **632**, using a message on frequency C_2 with a LOCAL FREQUENCY DOWNLOAD COMMAND CODE, central control station **420** sends the values of its local frequencies (e.g., f_5, f_6, f_7, f_8) to the in-wandering pager unit **422**. The central control station then (at step **634**) assigns to the in-wandering pager unit **422** a new time slot on its local frequencies using a message on frequency C_2 with a SLOT ASSIGNMENT COMMAND CODE. Processing of the change time slot command by the in-wandering pager unit **422** is understood with analogous reference to FIG. **5**, particularly steps **350**, **352**, and **354**.

Upon completion of step **634**, the in-wandering pager unit **422** is fully initiated into its new cell (e.g., $CELL_2$), and has left the jurisdiction of its former control station (e.g, $CELL_1$ and station S1). Accordingly, at step **636**, CPU **50** requests its I/O interface to issue a command on serial line **486**A which advises (using pager ID) that the in-wandering pager **422** is now under its jurisdiction, so that former jurisdictions (e.g., S1) can delete this pager unit from their pager directory files **56**. Such deletion is understood with reference to steps **604**-**608** as above-described.

In addition to illustrating geographical location of pager P1, stations S1 and S2, and cells $CELL_1$ and $CELL_2$, FIG. **9** shows the relative timing of communications occurring on common frequencies C_1-C_4. FIG. **9** specifically relates the timing of communications transmissions to specific ones of the aforedescribed steps executed by central control station **420** (the switching enabling routine of FIG. **11**) and by pager unit **422** (the channel switching routine of FIG. **10**).

Although the central control stations 420_x use the same common frequencies C_1-C_4, there is no interference or confusion of these signals transmitted from the control stations 420_x. The common frequencies C_1-C_4 are broadcast at a relatively lower power than the local frequencies f_1-f_4 so that reception of the common frequencies C_1-C_4 occurs only in a limited neighborhood (CFRR) about the central control station 420_x. Accordingly, pager units **422** traveling through the system receive common frequencies C_1-C_4 only in the limited and non-overlapping CFRRs.

System operational characteristics, such as cell diameter, CFRR diameter, power level of the local frequencies (e.g., f_1-f_4), and power level of the common frequencies (C_1-C_4) can be field adjusted to suit numerous factors, including particularly the terrain and topography of the geographical region covered by the system. By way of non-limiting example, in one embodiment, the radius of each cell is on the order of about 20 miles; while the radius of each CFRR is on the order of about 10 miles or less. In the same example, the power for transmission of the local frequencies can be in a range of from about 3 watts to 1000 watts; while the power for transmission of the common frequencies C_1-C_4 is preferably less than 2 watts.

Thus, the invention provides a two-way paging system which operates independently from a telephone system for wireless data communication between users. The invention minimizes use of available frequencies allowed by the Federal Communications Commission (FCC), using only four local frequencies f_1-f_4 for any given cell and (for expanded, multi-cellular coverage) only four common or switching frequencies C_1-C_4. In order to minimize the number of frequencies (e.g, channels) utilized, techniques of time division sharing and synchronization are employed. A transmission power differential between the local frequencies and the common frequencies is also employed. These techniques allow data transmission to be kept separate from different pagers and thus eliminate merging of data.

The switching technique of the present invention provides extended geographical coverage and minimizes paging time by increasing the number of frequencies utilized in a cell from four (e.g, the four local frequencies) to eight (the four local frequencies plus the four common frequencies).

In connection with verification of pager ID, it should be understood that a single pager registration file might be stored in a memory file of only one of a plurality of central control stations, and that in such case verification would constitute issuing a search command (on the serial links **486**) to locate a pager ID in the one (remote) memory file, with the results of the search being reported back to the inquiring central control station.

The keyboards illustrated herein can, in some embodiments, be multi-language keyboards or writing pads which permit typing of English, Chinese, or Japanese languages, for example. The writing pad is especially useful in countries such as Japan, Thailand, the Middle East or China where English-like alphabets are not used. The writing pad could also be used to sketch and transmit graphics. Moreover, data compression/de-compression techniques can be utilized in connection with data transfer.

While the invention has been particularly shown and described with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that various alterations in form and detail may be made therein without departing from the spirit and scope of the invention. For example, it should be understood that repeaters may be employed within cells to facilitate transmission when a pager unit ventures far from a central control station.

What is claimed:

1. A method of operating a two-way communication system between a plurality of communication devices which comprise at least one communication controller including a

first communication controller and a plurality of nodes including a first node, the method comprising:

receiving a clocking signal used to enable request signals including a first request signal from the first node, the clocking signal provided from the first communication controller;

when the first node has a communication message to transmit, and upon receipt of the clocking signal, transmitting the first request signal from the first node to the first communication controller; and

receiving an authorization signal at the first node from the first communication controller;

upon receipt of the authorization signal, transmitting the communication message from the first node subsequent to receiving said authorization signal to the first communication controller;

wherein each of the first request signal, the authorization signal, the communication message, and the clocking signal are transmitted on differing frequencies, and

wherein the clocking signal further enables a second request signal to be transmitted to the first communication controller by a second node, and wherein the second request signal can be provided simultaneous with transmission of the communication message.

2. The method of claim **1**, wherein the clocking signal can be received by the first node simultaneous with reception of the authorization signal.

3. The method of claim **1**, wherein the clocking signal can be received by the first node simultaneously with transmission of the communication message by the first node.

4. The method of claim **1**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node is less than the number of frequency channels.

5. The method of claim **1**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

6. The method of claim **1**, wherein the first request signal and the second request signal are contention free request signals.

7. A method of operating a two-way communication system between a plurality of communication devices which comprise at least one communication controller including a first communication controller and a plurality of nodes including a first node, the method comprising:

transmitting a clocking signal used to enable requests including a first request that can be received from the first node;

receiving the first request signal from the first node at the first communication controller subsequent to transmission of the clocking signal, the first request signal comprising information relating to a request for an allocation of resources by the first communication controller to the first node for the first node to transmit a communication message;

transmitting an authorization signal to the first node from the first communication controller in response to the first request signal; and

receiving the communication message from the first node subsequent to transmission of said authorization signal,

wherein each of the request signal, the authorization signal, the communication message, and the clocking signal are transmitted on differing frequencies, and

wherein the clocking signal can enable a second request signal to be transmitted to the first communication controller by a second node, and wherein the second request signal can be provided simultaneous with transmission of the communication message from the first node.

8. The method of claim **7**, wherein the second request can be received from the second node at the first communication controller simultaneously with transmission of the authorization signal to the first node.

9. The method of claim **7**, wherein the second request from the second node and the communication message from the first node can both be received simultaneously at the first communication controller with transmission of an authorization signal to a third node, said authorization signal to the third node being transmitted from the first communication controller subsequent to the first communication controller receiving a third request to transmit a communication message from the third node.

10. The method of claim **9**, wherein the second request from the second node and the communication message from the first node can both be received simultaneously at the first communication controller with transmission of the authorization signal to a third node and transmission of the clocking signal.

11. The method of claim **7**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the controller is less than the number of frequency channels.

12. A communication controller in a data network, the data network further including a plurality of nodes including a first node, the communication controller comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

transmit a clocking signal used to enable requests including a first request to be transmitted from the first node when the first node has a message to transmit;

receive the first request signal from the first node;

transmit an authorization signal to the first node in response to the first request signal; and

receive the communication message from the first node subsequent to transmission of the authorization signal;

wherein each of the clocking signal, the first request signal, the authorization signal, and the communication message are transmitted on differing frequencies, and

wherein the clocking signal further enables a second request to be transmitted from a second node, and wherein the second request signal can be received from the second node simultaneous with receipt of the communication message from the first node.

13. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

receive a clocking signal used to enable requests including a first request from the first node, the clocking signal provided from the first communication controller;

transmit the first request signal from the first node to the communication when the first node has a communication message to transmit;

receive an authorization signal from the first communication controller; and

transmit the communication message to the first communication controller subsequent to receiving said authorization signal;

wherein each of the clocking signal, the first request signal, the authorization signal, and the communication message are transmitted on differing frequencies, and

wherein the clocking signal enables a second request signal to be transmitted to the first communication controller by a second node, and wherein the second request signal can be provided simultaneous with transmission of the communication message by the first node.

14. The first node of claim **13**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

15. The first node of claim **13**, wherein the first request signal and the second request signal are contention free request signals.

16. The first node of claim **13**, wherein the clocking signal comprises a clock-aligning signal used to synchronize the requests.

17. The first node of claim **13**, wherein the first node further comprises a touch sensitive display input device.

18. The first node of claim **13**,

wherein the communication message from the first node comprises multiple data packets, and

wherein the interface of the first node is further controlled by the processor to transmit information relating to a total number of related ones of the multiple data packets being transmitted together, the total number providing a count value for the communication controller to determine when the multiple data packets being transmitted together are completely received.

19. The first node of claim **18**, wherein the interface is further controlled by the processor to:

transmit randomly generated information created by the first node; and

receive said randomly generated information returned from the communication controller to enable identification of the first node.

20. The first node of claim **19**, wherein the first node further comprises a touch sensitive display input device.

21. The first node of claim **20**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

22. The first node of claim **13**, wherein the interface is further controlled by the processor to:

transmit randomly generated information created by the first node; and

receive said randomly generated information returned from the communication controller to enable identification of the first node.

23. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

receive a clocking signal used to enable requests including a first request from the first node, the clocking signal provided from the first communication controller;

transmit the first request signal from the first node to the communication when the first node has a communication message to transmit;

receive an authorization signal from the first communication controller; and

transmit the communication message to the first communication controller subsequent to receiving said authorization signal,

wherein each of the clocking signal, the authorization signal, the first request signal and the communication message are transmitted on four separate frequency channels, and

wherein the clocking signal can be received by the first node simultaneous with reception of the authorization signal.

24. The first node of claim **23**,

wherein the communication message from the first node comprises multiple data packets, and

wherein the interface of the first node is further controlled by the processor to transmit information relating to a total number of related ones of the multiple data packets being transmitted together, the total number providing a count value for the communication controller to determine when the multiple data packets being transmitted together are completely received.

25. The first node of claim **24**, wherein the interface is further controlled by the processor to:

transmit randomly generated information created by the first node; and

receive said randomly generated information returned from the communication controller to enable identification of the first node.

26. The first node of claim **25**, wherein the first node further comprises a touch sensitive display input device.

27. The first node of claim **26**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

28. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

receive a clocking signal used to enable requests including a first request from the first node, the clocking signal provided from the first communication controller;

transmit the first request signal from the first node to the communication when the first node has a communication message to transmit;

receive an authorization signal from the first communication controller; and

transmit the communication message to the first communication controller subsequent to receiving said authorization signal,

wherein each of the clocking signal, the authorization signal, the first request signal and the communication message are transmitted on four separate frequency channels, and

wherein the clocking signal can be received by the first node simultaneously with transmission of the communication message by the first node.

29. The first node of claim **28**,

wherein the communication message from the first node comprises multiple data packets, and

wherein the interface of the first node is further controlled by the processor to transmit information relating to a total number of related ones of the multiple data packets being transmitted together, the total number providing a count value for the communication controller to determine when the multiple data packets being transmitted together are completely received.

30. The first node of claim **29**, wherein the interface is further controlled by the processor to:

transmit randomly generated information created by the first node; and

receive said randomly generated information returned from the communication controller to enable identification of the first node.

31. The first node of claim **30**, wherein the first node further comprises a touch sensitive display input device.

32. The first node of claim **31**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

33. A first node in a data network, the data network including a plurality of nodes including a first node, the first node comprising:

at least one processor;

a memory providing code to the at least one processor; and

an interface controlled by the at least one processor to:

receive a clocking signal used to enable requests including a first request from the first node, the clocking signal provided from the first communication controller;

transmit the first request signal from the first node to the communication when the first node has a communication message to transmit;

receive an authorization signal from the first communication controller; and

transmit the communication message to the first communication controller subsequent to receiving said authorization signal,

wherein each of the clocking signal, the authorization signal, the first request signal and the communication message are transmitted on four separate frequency channels, and

wherein the clocking signal can be received by the first node simultaneously with transmission of the first request signal by the first node.

34. The first node of claim **33**,

wherein the communication message from the first node comprises multiple data packets, and

wherein the interface of the first node is further controlled by the processor to transmit information relating to a total number of related ones of the multiple data packets being transmitted together, the total number providing a count value for the communication controller to determine when the multiple data packets being transmitted together are completely received.

35. The first node of claim **34**, wherein the interface is further controlled by the processor to:

transmit randomly generated information created by the first node; and

receive said randomly generated information returned from the communication controller to enable identification of the first node.

36. The first node of claim **35**, wherein the first node further comprises a touch sensitive display input device.

37. The first node of claim **36**, wherein a number of the differing frequencies comprises at least four frequency channels, and wherein a number of transceivers of the first node comprises less than the number of frequency channels but at least two transceivers.

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